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VITAMIN CONTENT OF FOODS

A SUMMARY OF THE CHEMISTRY OF VITAMINS UNITS OF MEASUREMENT, QUANTITATIVE ASPECTS IN HUMAN NUTRITION AND OCCURRENCE IN FOODS

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INTRODUCTION

Vitamins have assumed a high degree of importance since the first one was discovered some 30 years ago. The list of factors included under this category is a long and continually growing one, but at the present time vitamins A, B, and C are definitely known to be essential to the human adult. In addition to these three, children need a fourth—vitamin D. The vitamin D requirement of the adult has not yet been determined.

Vitamin E, which is generally included in any discussion of vitamins, is essential to rats and possibly some animals of larger species, but its function in human nutrition has not been demonstrated.

Vitamin G, known for some time to be needed by animals, will in all probability be shown to be an essential constituent of the diet of man. At one time vitamin G was thought to be identical with the factor preventive of pellagra, but it has recently been shown that the substance actually dealt with in most of the vitamin G studies is a flavin and not the "pellagra-preventing factor."

The results of researches as they have accumulated from year to year indicate a quantitative relationship between normal physiological function and vitamin intake. Deprivation of any one of the vitamins

[1] The authors wish to acknowledge the suggestions and assistance given by Sybil L. Smith, of the Office of Experiment Stations. Acknowledgment is also given to H. C. Sherman, of Columbia University, for the use of unpublished data and also for his advice and suggestions; to those who critically reviewed the manuscript; and to the many others who have assisted.

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results in the development of symptoms specific for that vitamin. Low vitamin intake may result in subacute or chronic manifestations not easily recognized as due to vitamin deficiency. The planning of adequate diets therefore involves information on vitamin requirements and knowledge of the vitamin content of foods.

This bulletin brings together quantitative data on the occurrence of vitamins A, B, C, D, and G in foods, and includes a brief summary of the chemical nature of each of these factors and some of the more common units used at various times to indicate vitamin concentration in foods. Although there is still little information on vitamin requirements of human beings, a few data relative to certain aspects of this question are discussed.

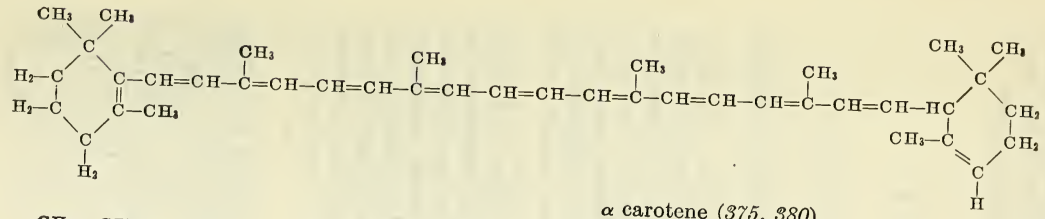
CHEMICAL NATURE OF THE VITAMINS

Considerable information is now available concerning the chemical nature of vitamins A, B, C, D, E, and G. The material presented here deals primarily with those developments leading to identification of these vitamins as far as this has been accomplished. The literature cited is by no means complete but includes references to significant reports on each point mentioned. The reader is referred further to summaries prepared by Bauer (*43*),[2] Bills (*55*), Dutcher (*184*), Harris (*273*), Josephson (*372*), Karrer (*374*), King (*393*), Kuhn (*420*), MacLeod (*465*), Morton (*526*), Munsell (*532*), Percival (*558*), Steenbock (*665*), and Willstaedt (*739*).

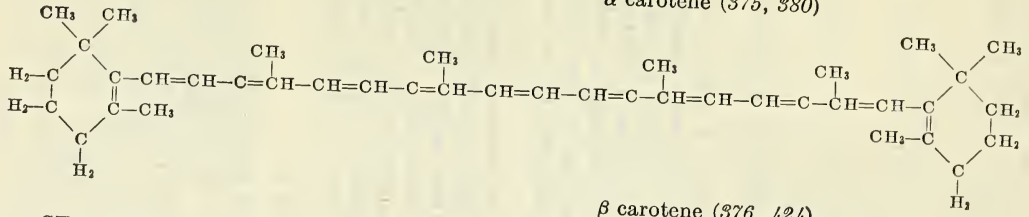
VITAMIN A

Long before anything was known of the chemical nature of vitamin A, plants having a yellow or green color were recognized as rich sources of this vitamin. Their vitamin A activity has been traced to the presence of carotenoid pigments α, β, or γ carotene (*210*, *382*, *421*), and more recently the xanthophyll pigment kryptoxanthin (*426*). All of these may be converted into vitamin A in the liver (*508*) and are therefore called "precursors" of vitamin A. Vegetable carotin is almost never a single carotene, being usually a mixture of the three forms. The chemical formulas for the three carotenes and kryptoxanthin are given below:

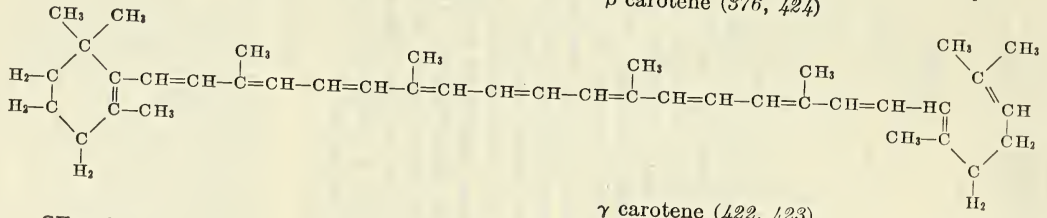
[2] Italic numbers in parentheses refer to Literature Cited, p. 137.



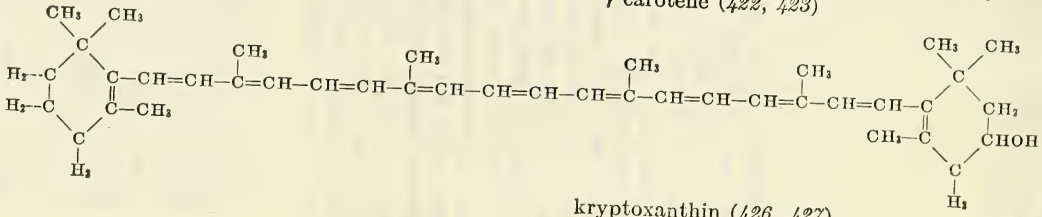
α carotene (*375*, *380*)



β carotene (*376*, *424*)



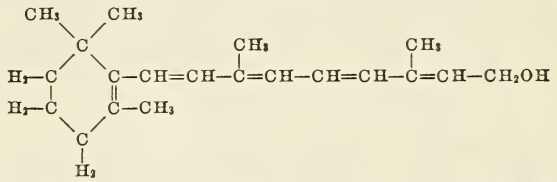
γ carotene (*422*, *423*)



kryptoxanthin (*426*, *427*)

Each of these substances has in its molecular structure at least one β-ionone ring and a side chain of alternate doubly and singly bound carbon atoms containing nine double bonds and four methyl groups. Beta carotene is symmetrical, having two β-ionone rings.

Vitamin A, which has one β-ionone ring and a side chain containing four double bonds and two methyl groups has also been shown by esterification reactions to contain one hydroxyl group characteristic of alcohols (*293*, *378*). The formula given below was proposed (*292*, *378*, *379*) to represent its chemical configuration:



Recent claims for the synthesis of vitamin A give further evidence for the validity of this formula (*236*).

By comparing the formula for vitamin A with those for the carotenes, it is readily seen that theoretically one molecule of β-carotene should give rise to two molecules of vitamin A, while one molecule respectively of α- and γ-carotene and kryptoxanthin should each furnish one molecule of vitamin A. Experimental evidence obtained with animals showing that β-carotene as a source of vitamin A is twice as potent as γ-carotene has confirmed these observations with respect to these two carotenes (*425*).

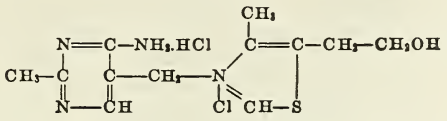
Vitamin A has been separated as a viscous, light-yellow oil (*377*) having an absorption maximum at 328 mμ, whereas the carotenes do not have a band in this region. This makes possible a differential determination of vitamin A and carotene (*70*). In plants vitamin A exists only in the form of the precursors α-, β-, and γ-carotene and kryptoxanthin; while in animal products, such as milk and butter, both carotene and vitamin A may occur. Fish-liver oils, however, contain only vitamin A.

VITAMIN B

The term "vitamin B complex" has been adopted to refer to a group of water-soluble substances having as one other common characteristic the fact that they all occur in yeast. This group includes the original (antineuritic) vitamin B (B_1, British terminology) (*15*), vitamin G (growth-promoting flavin), vitamin B_3 (pigeon weight-maintenance factor) (*733*), vitamin B_4 (rat growth factor) (*587*), the recently announced vitamin B_6 (antidermatitis factor) (*261*), and several others the existence of which has been suggested. Vitamin B_2 (British terminology) has been used to designate the "heat stable fraction" of the vitamin B complex. The discussion presented in this bulletin is limited to vitamins B and G (p. 8).

Vitamin B, known to be an organic base containing nitrogen and sulphur (*324*), has been separated by a number of investigators from yeast and rice polishings in the form of its crystalline hydrochloride (*353*, *396*, *550*, *638*, *735*, *748*, *749*). The empirical formula has been reported as $C_{12}H_{18}O_2N_4S.2HCl$ and as $C_{12}H_{16}ON_4S.2HCl$ (*354*, *397*,

748), with more recent studies indicating that the second formula is in all probability the correct one (*737*, *750*). A long series of intensive investigations concerning the chemical nature of this vitamin has established the fact that a thiazole nucleus and a pyrimidine nucleus are embodied in its molecular structure (*85*, *86*, *110*, *732*, *734*). It has been suggested that the complete structure of vitamin B hydrochloride may be represented by the following formula (*472*, *731*):



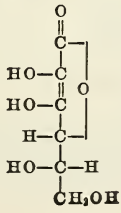
VITAMIN C

Two independent and distinctly different points of attack were responsible for the chemical identification of vitamin C. During a long series of investigations on the concentration of vitamin C from lemon juice a marked parallelism was noted between the reducing capacity of plant and animal tissues and their vitamin C content (*693*, *763*, *764*). Other studies on the mechanism of biological oxidation-reduction systems resulted in the separation from adrenal cortex of a strong reducing substance having the empirical formula $C_6H_8O_6$ (*684*). This substance, which was acidic in character and resembled the carbohydrates in reducing power and color reactions, could not be identified with any known substance, and was called hexuronic acid. In the report in which these findings were given (*684*), the statement was made that studies on the reducing substances of lemon juice had "established interesting relations between vitamin C and the reducing properties of plant juice." Chemical analysis was made of the hexuronic acid, and when later work indicated that it was in reality vitamin C (*679*, *680*), a tentative formula was suggested (*298*, *327*).

The second line of attack involved the separation from lemons, oranges, grapefruit, paprika, and cabbage of a substance having the properties of vitamin C, and which on chemical analysis proved to be identical with the hexuronic acid isolated from adrenal cortex (*394*, *721*).

Further study revealed that vitamin C does not contain the characteristic uronic acid structure of true hexuronic acid, but is, rather, a lactone of an unsaturated acid. For this reason and because of its antiscorbutic properties, the name "ascorbic acid" was proposed (*686*), although the term "cevitamic acid" is also sometimes used.

Several methods have been devised for the synthesis of both the d- and l- forms of ascorbic acid (*21*, *290*, *291*, *491*, *589*, *590*), only the latter of which shows vitamin C activity. The structural formula of the l- form may be represented as follows:



The suggestion has been made that vitamin C activity may be related to stereochemical configuration (*262*). In the active l-ascorbic acid, for instance, the configuration around the fourth carbon atom is dextrorotatory, while in the inactive d- form it is laevorotatory. The fifth carbon atom may also be involved, since in inactive d-ascorbic acid and d-arabo ascorbic acid, which is about one-twentieth as potent as l-ascorbic acid, the arrangement of the OH and H around the carbon atom is the reverse of that in l-ascorbic acid.

When vitamin C is treated with mild oxidizing agents a "reversibly oxidized" product, dehydroascorbic acid, is formed, which may also act as vitamin C (*72*, *228*, *328*, *597*), and which is capable of being reduced again to the original form by suitable reagents (*72*). Drastic oxidation, on the other hand, results in the formation of an irreversibly oxidized product and loss of antiscorbutic property (*135*, *156*, *364*, *694*, *695*, *760*). The reducing property of vitamin C makes it possible under suitable experimental conditions to use reversible dyes of high oxidation potential (indophenols) for the quantitative determination of vitamin C. The validity of results obtained by this method depends, of course, upon whether the vitamin is present as the "active"—that is, the reduced—form, or as the reversibly oxidized form. Both of these function biologically as vitamin C, but only the former may be detected by the dye.

Investigations are being conducted to determine whether vitamin C may exist in tissues in the reducible (reversibly oxidized) as well as the reduced form (*386*), and whether oxidation of the active form is prevented by some protective mechanism, possibly glutathione (*46*, *385*, *486*, *560*, *765*).

VITAMIN D

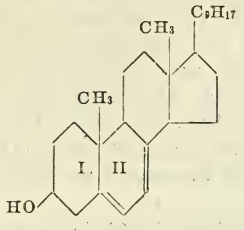
Vitamin D is derived from the plant sterol ergosterol ($C_{28}H_{43}OH$) when this substance is exposed to the action of ultraviolet light (*1*, *317*, *608*). The name "calciferol" was proposed by the English workers (*16*) for the substance isolated in crystalline form, and the terms "vitamin D_1" and "vitamin D_2" appeared in the German literature (*745*) at one time to designate two substances thought to be different forms of vitamin D obtained from ergosterol. Vitamin D_2 is now considered identical with calciferol, while vitamin D_1 is described as an addition compound of vitamin D_2 and an inactive substance, lumisterin (*743*).

Irradiation of ergosterol results in the formation of several isomeric compounds (*595*, *607*, *641*, *743*). Five of these substances, including calciferol, which is the only one having antirachitic properties, have been separated and shown to differ in melting points, specific rotation, solubilities, and absorption maxima. During the transformation these substances appear in the following sequence (*641*, *743*, *744*):

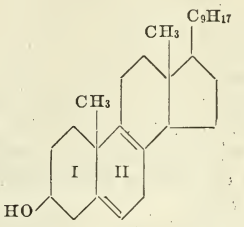
Ergosterol
↓
Lumisterol
↓
Tachysterol
↓
Calciferol (vitamin D (D_2))

On overirradiation the products toxisterol, suprasterol I, and suprasterol II are formed (*607*).

Although vitamin D and ergosterol have both been isolated (*16, 56, 596, 741*), their exact structural configurations have not been determined. Ergosterol probably has either configuration A (*742*) or B (*183*) shown below.

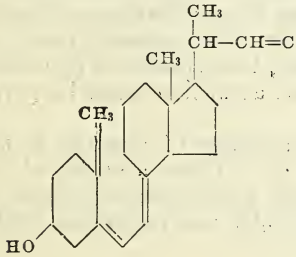


A

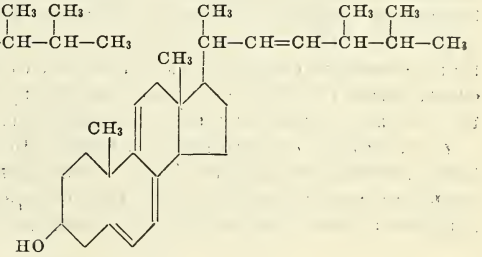


B

Ergosterol is tetracyclic, whereas vitamin D is tricyclic. The suggestion has been made that the transition from a four ring to a three ring system involves a rearrangement of the double bonds, and a break in the unsaturated ring II which takes place in the change from lumisterol to tachysterol. Several hypotheses have been offered as to how and where the break takes place (*151, 294, 295, 446, 527, 607, 747*), and although there is experimental evidence in support of each, either formula A (*747*) or B (*607*) given below will probably be shown to express the configuration of calciferol.

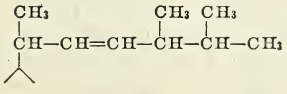


A

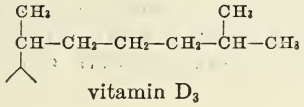


B

Investigations on vitamin D from different sources indicate that this factor may exist in more than one form. The provitamin D of plant origin seems, for instance, to be different from the provitamin D of animal origin (*51*), and the vitamin D of irradiated ergosterol differs in some of its chemical and physical properties from the vitamin D of cod-liver oil (*209, 618*). Of interest in connection with the last point are findings recently reported by the German investigators (*82, 83, 746*) showing that the vitamin D (D_3) separated from tuna fish-liver oil may differ from calciferol in the configuration of the side chain as shown below.



calciferol (vitamin D_2)



vitamin D_3

However, much of the evidence leading to the belief that there is more than one form of vitamin D consists of differences in the relative antirachitic effectiveness of substances as determined by tests with different species of animals. On the basis of equivalent number of rat units of vitamin D, the vitamin D of irradiated yeast is much more effectively transferred to milk by the cow than is the vitamin D of irradiated ergosterol (*305, 418, 616*) and cod-liver oil is several times richer as a source of vitamin D for the chick than irradiated ergosterol (*50, 51, 168, 308, 416, 479, 542, 612, 615, 671*). Bluefin tuna oil when tested with rats appears much richer in vitamin D than cod-liver oil, while with chicks it is only one-sixth as effective as cod-liver oil (*58*).

Some investigators believe that irradiated ergosterol is not so effective as cod-liver oil for the cure and prevention of rickets in children (*36, 304, 306, 315, 359*). A recent report covering extensive investigations along this line, however, does not support this view (*202*).

VITAMIN E

Vitamin E, sometimes referred to as the antisterility vitamin, is considered to be required by the rat and other animals for successful reproduction (*211*). Whether or not it is important in human nutrition has not been demonstrated, although the successful results obtained in the treatment of repeated abortion with wheat-germ oil known to be rich in vitamin E indicate that it may have significance (*145, 708, 719*). Even though vitamin E should eventually prove to be an essential constituent of the diet of man, this vitamin is so widely distributed in natural foods that no special attention need be given to it in the varied or well-balanced diet.

An alcohol, α-tocopherol, having the properties of vitamin E has been recently separated from wheat-germ oil. From a study of the urethane and allophanate of this compound, which was separated as a light-colored viscous oil, the formula $C_{29}H_{50}O_2$ was suggested (*212*).

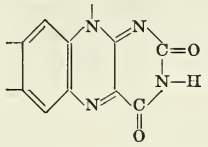
VITAMIN G

The term "vitamin G" was introduced when it became definitely known that many of the vitamin B-free basal diets used in making assays were also deficient in a heat stable, growth-promoting factor, as well as the heat labile vitamin B. Rats maintained on diets devoid of this new factor showed symptoms somewhat similar to those of pellagra, and vitamin G was accordingly defined as "the more heat stable, water soluble dietary factor (in yeast) called the pellagra-preventive or P-P factor by Goldberger and associates and which also has to do with maintenance and growth" (*15*). Subsequent work indicated that the substance actually dealt with in the majority of cases was not the pellagra-preventive factor but a growth-promoting factor belonging to the class of substances known as flavins.

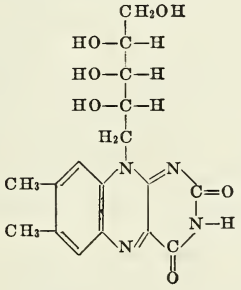
Unfortunately there has been no general agreement as to whether or not the name "vitamin G" should be restricted to designate the flavin (or flavins) possessing the power to promote growth and to prevent a condition in the rat sometimes referred to as a "nonspecific dermatitis." However, since a large proportion of the vitamin G values reported in the literature were obtained by the Bourquin-

Sherman or similar methods, and these have been shown to be essentially measures of growth-promoting flavin (*63*), the term "vitamin G" is used throughout this bulletin in this sense.

As a group the flavins may be characterized as water-soluble, yellow green-fluorescent pigments occurring in natural products either as free dialyzable pigments or in combination with protein. A number of flavins have been isolated and their vitamin G activity determined (*204, 381, 428, 429, 435, 664*). Lactoflavin, found in fairly high concentration in milk and in green leaves, has the highest vitamin G activity of any so far studied (*429*) and is accepted by many investigators as identical with vitamin G. Several flavins have been synthesized (*431, 432, 433, 436*) and the chemical structure common to all of these substances has been shown to be the iso-alloxazine nucleus, having the following configuration:



Lactoflavin in addition to other properties is identical in optical rotation and vitamin G activity with 6, 7 dimethyl 9-d-ribo-flavin, which by synthesis has been shown to have the following structural configuration (*432*):



This substance may be considered a derivative of 6, 7, 9 trimethyl iso-alloxazine (lumilactoflavin) (*431*) with a carbohydrate side chain (d-ribose) substituted for the methyl group in position 9. Similar compounds have been prepared from other carbohydrates and shown to differ widely in vitamin G activity. That synthesized from d-xylose, for instance, has very little activity, while the one from l-arabinose possesses only one-third the vitamin G activity of lactoflavin (*432*).

It has been suggested that flavins may function in cell respiration, since they enter into reversible oxidation-reduction systems (*53, 430, 434*). The "yellow respiratory enzyme" separated from yeast (*713*) is known to contain as the active group a water-soluble, green-fluorescent pigment (*714, 715*). Furthermore, both araboflavin and lactoflavin are converted in vivo into a yellow enzyme through combination with a protein by means of a phosphoric acid group (*420*). Thus there is the interesting sequence of a pigment (lumilactoflavin) combining with a carbohydrate to give a vitamin and this in turn uniting with a protein to give an enzyme (*430*).

DEVELOPMENT OF OFFICIAL UNITS TO EXPRESS VITAMIN POTENCY

Each of the known vitamins has been discovered by observing the specific pathological condition that develops when it is lacking in the diet or is present in amounts too small for optimum nutrition. If a food containing the vitamin is added to the diet, the symptoms usually disappear and the animal returns to normal. It was also observed that in the case of each vitamin, a definite quantity is needed either to prevent the onset of the deficiency symptoms or to cure them when once they have developed.

Since chemical methods were not available for determining vitamin potency, because little was known of the chemical identity of the vitamins, quantitative biological methods have been developed on the basis of the above observations. Laboratory test animals such as rats, guinea pigs, and pigeons, have served as subjects, and a unit of the vitamin in question has been defined as that quantity required to produce a certain specified effect under the conditions described for the method. Some units were defined as the quantity of vitamin necessary to induce a certain rate of recovery, usually gain in weight, and others as the quantity sufficient just to prevent the onset of specific symptoms associated with a deficiency of the vitamin.

Inasmuch as an unlimited number of different units might be set up on these bases, there was a tendency for each investigator to describe his own vitamin units. Consequently, the need for establishing official units for expressing vitamin potency as well as reliable methods of assay became an important problem.

As early as 1921 a committee on vitamin research was appointed by the American Chemical Society (*9*). This committee acted more as a clearing house for information on vitamin research in general than on methods alone. In 1924 a group of individuals interested in the establishment of approved methods for the quantitative determination of vitamins made an unsuccessful attempt to induce the Division of Biological Chemistry of the American Chemical Society to assume responsibility for sponsoring the development of adequate methods of vitamin assay (*332*).

A biological method for measuring vitamin A was included in the tenth edition of the United States Pharmacopeia (*705, p. 469*). A unit of vitamin A, referred to as the U. S. P. X. unit, was defined as—

> the minimum daily amount . . . required to cure induced symptoms of vitamin A starvation in young albino rats, and to cause a gain in weight of from 10 to 20 grams within a period of 35 days under the conditions of growth and diet specified in this assay.

However, this method, which had been worked out before vitamin D was recognized as a dietary essential, made no immediate provision for supplying vitamin D to the test animals. In actual practice, therefore, it gave irregular results and soon fell into disrepute.

In 1927 the American Drug Manufacturers' Association established a vitamin assay committee for the purpose of studying the United States Pharmacopeia method for vitamin A. The work of this committee was extended in 1928 to include investigation of a possible method for measuring vitamin D. This committee made suggestions for improving the vitamin A technique and described a method for determining vitamin D. A unit of vitamin D was defined (*331*) as—

the minimum average *daily* amount (of vitamin D) required to produce, in 60 percent of the experimental animals (rats) in any one group, a degree of recalcification represented by a narrow continuous "line" across the metaphysis of the leg bones of the rats kept and fed under the conditions as specified in the assay.

This unit is referred to as the A. D. M. A. unit of vitamin D. Subsequent reports of this committee which worked in close cooperation with the Drug Division of the Food and Drug Administration, United States Department of Agriculture, offered suggestions for improvement of the methods originally presented.

The U. S. P. X. vitamin A unit and the A. D. M. A. vitamin D unit have been extensively used. However, although the biological methods of assay were carefully standardized in many details, it was increasingly evident that results based on animal behavior were very seldom comparable at different times and in different laboratories. There were too many factors that could not be controlled. Experimental animals from different colonies did not show similar degrees of response, and ration supplies obtained from different manufacturers or even from the same manufacturer at different times showed annoying variations in composition.

During this time the British Medical Research Council's committee on accessory food factors was also working to find ways of expressing vitamin potency. As early as 1928 the Pharmaceutical Society of Great Britain had adopted a particular sample of irradiated ergosterol prepared at the National Institute for Medical Research as a Standard of Reference in determining vitamin D potency (*123*). This was the first vitamin preparation used as a Standard of Reference. Its potency was such that 0.0001 mg administered daily caused complete healing of induced rickets in rats.

In 1929 the Council on Pharmacy and Chemistry of the American Medical Association adopted the term "viosterol" to designate irradiated ergosterol and "viosterol in oil" for a preparation made up of this substance dissolved in oil (*10, 11*). The terminology "10D", "20D", etc., was adopted to indicate the vitamin D potency of these preparations in terms of the vitamin D potency of a cod-liver oil of definite vitamin D content as measured by the rat-assay method of Steenbock. The Steenbock unit of vitamin D was defined as "the *total* amount of vitamin D which will produce a narrow line of calcium deposits in the rachitic metaphyses of the distal ends of the radii and ulnae of standard rachitic rats in a period of 10 days" (*671*). The particular sample of oil selected for reference contained one Steenbock unit of vitamin D per 0.075 g or 13.3 units per gram. Although referred to as an oil of standard potency, it was rather a poor source of vitamin D compared to present day medicinal oils.

The Medical Research Council of Great Britain (*248*) authorized the statement that an irradiated solution of ergosterol in oil had been accepted as a Standard of Reference for vitamin D. This standard was prepared and maintained by the National Institute for Medical Research. A unit of vitamin D was defined as the antirachitic potency of 0.0001 mg of the ergosterol used in the preparation of the standard.

The problem of vitamin standards had been considered by the Health Organisation of the League of Nations at the Second International Conference on the Standardisation of Biological Products in 1925 (*442*). At this time it seemed that the assay of only the growth-promoting effect of vitamin A could be discussed. By 1930 when the knowledge of the chemistry of vitamins had increased exten-

sively, the problem of establishing vitamin standards was again taken up by the Health Organisation of the League of Nations under the auspices of the Permanent Commission on Biological Standardisation. A conference was held in London June 17–20, 1931 (*441*). Members were present from Sweden, Denmark, the Netherlands, the United States, France, Germany, and Great Britain. The United States Pharmacopeia Vitamin Advisory Committee appointed in the spring of 1931 had prepared a report for the meeting, and three of its members attended the conference (*13*).

This conference adopted provisional Standards of Reference for vitamins A, B, C, and D and units for expressing potency in terms of these standards. They are referred to as International Standards of Reference and International Units, respectively. The International Standards for vitamins A, C, and D were provisional for a 2-year period, the vitamin B standard for 5 years.

A second conference was held in London June 12–14, 1934 (*443*). Again International Standards for vitamins A, B, C, and D only were adopted, although standards for vitamin B_2 (G) and vitamin E were also considered. The 1931 Standards of Reference for vitamins A and C were altered, but no change was made in the International Standards for vitamins B and D as originally adopted. Where changes in standards were made, the quantities used in the definitions were such that the International Units adopted in 1934 were equivalent in value to the corresponding units adopted in 1932. The term "provisional", referring to the permanence of the standards, was no longer used. The conference expressed the opinion that for the present at least the vitamins considered should be estimated by means of biological tests carried out simultaneously with the respective Standard of Reference.

INTERNATIONAL UNITS AND OTHERS IN COMMON USE

The definitions given for the International Units and International Standards of Reference are those adopted at the 1934 Conference of the League of Nations Committee on Biological Standardisation (*443*).

Prior to the adoption of the International Standards of Reference, several vitamin units had come into common use (pp. 10–11). A high percentage of the values for the foods already assayed are expressed in these units, and for this reason, definitions of the more common ones are given here. Attempts have been made to determine conversion factors for changing them to International Units, and the various factors that have been suggested are given. However, practically all of these older units have been defined in terms of animal behavior, and therefore have no absolute value. Consequently there is no fixed relation between the biological and International Units, and if the factors given are used, it should be with the full realization that at most they are only approximations.

VITAMIN A UNITS

DEFINITIONS

International Standard of Reference.[3]—Pure beta carotene conforming to the requirements given for chemical and physical constants.

[3] Quantities of these standards for purposes of assay may be obtained by application to the Protein and Nutrition Division, Bureau of Chemistry and Soils, U. S. Department of Agriculture, or to E. Fullerton Cook, Forty-third Street and Woodland Avenue, Philadelphia, Pa.

A sample of cod-liver oil [4] carefully assayed in terms of the International Standard under the supervision of the United States Pharmacopeia Vitamin Advisory Committee is available as a subsidiary standard.

International Unit.—The activity of 0.6 microgram (0.6γ) of the International Standard of Reference.

U. S. P. (United States Pharmacopeia) XI (1936) unit.—Same as International Unit.

Sherman-Munsell unit (644) (U. S. P. X. or A. D. M. A.).—That amount of vitamin A which when fed daily (six times per week [5]) just suffices to support a rate of gain of 3 g per week during an experimental period of 8 weeks in a standard test animal (rat) previously depleted of its store of vitamin A.

CONVERSION FACTORS

One Sherman or Sherman-Munsell unit equals approximately 1.4 International Units (*44, 120, 258, 509, 614*).

One International Unit equals more than two Sherman units.[6]

VITAMIN B UNITS

DEFINITIONS

International Standard of Reference.[3]—The adsorption product of vitamin B (B_1) from rice polishings prepared in the Medical Laboratory, Batavia, Java, by the method of Seidell as described by Jansen and Donath.

International Unit.—The vitamin B (B_1) activity of 10 mg of the International Standard adsorption product.

Sherman-Chase unit (98).—That amount of vitamin B which when fed daily (six times per week) will induce in a standard test animal (rat) depleted of its store of vitamin B a gain of 3 g per week during a test period of 8 weeks.

CONVERSION FACTORS

One International Unit is given by one investigator as equivalent to four Sherman-Chase units (*176*), while others give it a value of two Sherman-Chase units (*717*).[7]

VITAMIN C UNITS

DEFINITIONS

International Standard of Reference.[3]—l-ascorbic acid conforming to the specifications given as to chemical and physical constants.

International Unit.—The vitamin C activity of 0.05 mg of the International Standard, l-ascorbic acid. This is about one-tenth of the daily dose necessary to prevent development of gross macroscopic scorbutic lesions in young guinea pigs maintained on a scurvy-producing diet.

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[3] See footnote on p. 12.

[4] Small quantities of this oil for purposes of assay may be purchased from E. Fullerton Cook, Forty-third Street and Woodland Avenue, Philadelphia, Pa.

[5] In the original definition "daily" meant seven times per week. A survey of practices in many laboratories where extensive vitamin A assay work is under way indicated, however, that the more usual interpretation is six times a week. Inasmuch as daily is also defined as six times per week in the official United States Pharmacopeia method, it is so interpreted in this bulletin. In the tables the necessary corrections in values have been made where a 7-day week is known to have been used in an assay.

[6] E. B. Meigs, U. S. Department of Agriculture. Private communication.

[7] E. M. Nelson, U. S. Department of Agriculture. Private communication.

Sherman unit (643; 645, p. 168).—That amount of vitamin C (minimum protective dose) which when fed daily will protect a 300-g guinea pig from scurvy during a period of 90 days.

CONVERSION FACTOR

One Sherman unit equals 10 to 15 International Units (*47, 276, 389*).

VITAMIN D UNITS

DEFINITIONS

International Standard of Reference.[3]—A solution of irradiated ergosterol prepared at the National Institute for Medical Research, London. The International Conference recommended that when the supply of this International Standard solution is exhausted it be replaced by an equivalent solution of pure crystalline vitamin D in olive oil of such strength that 1 mg contains 0. 025 microgram (0. 025γ) of crystalline vitamin D (calciferol). A sample of cod-liver oil [4] carefully assayed in terms of the International Standard under the supervision of the United States Pharmacopeia Vitamin Advisory Committee is available as a subsidiary standard.

International Unit.—The vitamin D activity of 1 mg of the International Standard solution of irradiated ergosterol found equal to 0.025 microgram of crystalline vitamin D.

U. S. P. (United States Pharmacopeia) XI (1936) unit.—Same as International Unit.

Steenbock unit (671).—"The *total* amount of vitamin D which will produce a narrow line of calcium deposit in the rachitic metaphyses of the distal ends of the radii and ulnae of standard rachitic rats in a period of ten days."

A. D. M. A. (American Drug Manufacturers' Association) unit (331).—The average *daily* amount of vitamin D—

> required to produce, in 60 percent of the animals in any one group, a degree of recalcification represented by a narrow continuous "line" across the metaphysis of the leg bones of the rats which have been kept and fed under the conditions as specified in the assay. . . . The average daily dose is understood to be the total amount of (vitamin D) given divided by the length of the test period, 10 days.

CONVERSION FACTORS

One Steenbock unit equals 3.2 International Units (*613*) or 3.33 International Units (*269*).

One Steenbock unit equals 10 A. D. M. A. units by definition (*331, 671*) but is also given as equivalent to 8. 8 A. D. M. A. units (United States Pharmacopeia Vitamin Advisory Board).

VITAMIN G UNIT

DEFINITION

Sherman-Bourquin unit (73).—That amount of vitamin G (flavin) which when fed daily to a standard test animal (rat) during a test period of 8 weeks will give an average gain of 3 g per week in addition to any appreciable gain in the group of control test animals on the vitamin G-free ration.

[3] See footnote on p. 12.
[4] See footnote on p. 13.

INTERNATIONAL STANDARDS OF REFERENCE IN VITAMIN ASSAYS

The Standards of Reference now available for vitamins A, B, C, and D make it possible to assay materials for these vitamins with a fair degree of accuracy. The general plan of procedure is to determine the quantity of the test material that will give the same effect as a selected quantity of the standard, generally the same as or some multiple of the quantity used in defining the unit.

Wherever they can be used, chemical or physical methods of analysis, of course, give a greater degree of accuracy than biological tests. Unfortunately, chemical or physical methods for determining vitamin potency cannot yet be relied upon entirely, since they are not assuredly specific. It is customary, therefore, either to use biological methods exclusively or to run parallel biological and chemical or physical tests.

Difficulties attendant upon "matching doses" in biological assays—i. e., selecting quantities of test material and of the standard that will give identical effects—are obvious to anyone familiar with this type of work. The accuracy of the final estimate of the potency of the test material depends on how closely the quantity of the test material, judged from the results of the assay to produce the same effect as the standard, actually approximates the quantity of test material that would give the same effect. Unfortunately many investigators when analyzing the results of their assays have neglected to give proper attention to this important point. Many merely select for their calculation the "dose" of test material that gave "most nearly" the same effect as the standard, although oftentimes it is very evident that this was as much as 200 to 300 percent of the true value. Such a practice if continued will detract seriously from the importance of the International Standards of Reference as vehicles for deriving vitamin values. It is because of this practice that opportunity is taken to bring to the attention of investigators proposed devices for accurately determining vitamin potency in terms of International Units by biological methods.

Two ways of carrying out assays to attain this end are given in the literature. One of these involves the use of a "curve of reference" relating unitage of standard to effect produced (*132*, *192*). In this method one group of test animals is given a selected quantity of the standard and the other a quantity of the test material estimated to give the same effect as the standard. In the second device a "curve of response" is used relating quantity of test material administered to effect produced (*127*, *129*). In this case the standard is given at one level and the test material at three or more.

Certain precautions in establishing the groups of test animals are essential irrespective of which of these devices is used. All of the groups in a single test must be comparable; that is, whenever an animal is assigned to one group, a comparable animal of the same sex, weight, and dietary history must be assigned to each other group. In the case of rats it is possible to make the added specification that they shall be litter mates. And not only must the different groups used be exactly comparable, but each must contain enough individuals to permit of testing the reliability of the results statistically.

In either one of these methods, if the investigator is fortunate enough to select a level of test material that gives the same effect as the quantity of standard administered, then the potency of the test mate-

rial may be calculated without further ado as shown below. The limits within which results may be considered to be identical depend upon the method being used and the sensitivity of the test and should be indicated when results are reported.

$$\left.\begin{array}{l}\text{Units of vitamin in the}\\ \text{dose of test material}\\ \text{judged to give the same}\\ \text{effect as the standard}\end{array}\right\}=\left\{\begin{array}{l}\text{Units of vitamin in the}\\ \text{dose of standard ad-}\\ \text{ministered}\end{array}\right.$$

Since the unitage of the standard is known, it further follows that:

$$A\left\{\begin{array}{l}\text{grams test}\\ \text{material}\end{array}\right\}\times X\left\{\begin{array}{l}\text{units per gram}\\ \text{test material}\end{array}\right\}=B\left\{\begin{array}{l}\text{grams standard}\\ \text{administered}\end{array}\right\}$$

$$\times Y\left\{\begin{array}{l}\text{units of vitamin per}\\ \text{gram standard}\end{array}\right\}$$

or

$$X\left\{\begin{array}{l}\text{units per gram}\\ \text{test material}\end{array}\right\}=\frac{B}{A}\times Y$$

However, there is slight chance of arbitrarily selecting a quantity of test material that will give the same effect as the dose of the standard unless extensive preliminary tests are made. When the effects are not identical, then the potency of the test material must be calculated from either the curve of reference or the curve of response, depending on which method was followed in making the assay.

THE CURVE OF REFERENCE

The curve of reference is derived by plotting the result obtained—gain in weight, for example—with groups of test animals given graded quantities of the standard against unitage of the respective doses of the standard. Usually four or five points—that is, values obtained with four or five groups of animals—are sufficient to establish the trend, although additional points give a more reliable curve. The scales for expressing the values are, of course, arbitrarily selected, and should be so chosen that the values read from the curve of reference are compatible with the degree of accuracy of the values used to establish the curve.

When using the curve of reference for calculating results of an assay, it is essential that the groups of assay animals have the same sex distribution as the groups used to determine the curve of reference. It is simpler, therefore, if in both cases this is a 1 : 1 ratio, even though it requires a larger supply of test animals from which to select. The most sensitive part of the curve—i. e., the part where the greatest change in effect occurs with the smallest increase in quantity of the standard administered—is, of course, the most important part and should be determined with care. When once established, the curve of reference may then be used in successive assays, although it may be revised as new data accumulate.

When this curve is used calculations are made as follows: The unitage (C) corresponding to the effect produced by the dose of test food fed in the assay and the unitage (D) corresponding to the effect pro-

duced by the quantity of the standard used in the assay are read from the curve of reference. The following relation then holds:

$$A\left\{\begin{matrix}\text{grams test}\\ \text{material}\end{matrix}\right\}\times X\left\{\begin{matrix}\text{units per gram}\\ \text{test material}\end{matrix}\right\}:$$

$$B\left\{\begin{matrix}\text{grams standard}\\ \text{administered}\end{matrix}\right\}\times Y\left\{\begin{matrix}\text{units of vitamin}\\ \text{per gram of standard}\end{matrix}\right\}::C:D$$

or

$$X\left\{\begin{matrix}\text{units per gram}\\ \text{test food}\end{matrix}\right\}=\frac{BC}{AD}\times Y$$

THE CURVE OF RESPONSE

The curve of response, derived in much the same way as the curve of reference, is established from the results obtained by administering graded doses of the test material to comparable groups of animals. It has been extensively used in the nutrition laboratories of the Bureau of Home Economics and was originally employed, although not described, in the vitamin A method worked out by Munsell (*529*). The test material is administered at at least three levels, one designed to give an effect approximating that obtained with the standard, one an effect somewhat greater, and one less. The curve of response is then obtained by plotting the averages of the results, gain in weight, obtained with the several levels against the respective quantities of test material. As in the curve of reference, an arbitrary scale is used, and the same precautions should be observed in choosing it.

If the results obtained with the test material describe a smooth curve and if no one level of test material gave exactly the same effect as the standard, then calculations are made as follows: the quantity (A_1) of test material that should give the same effect as the standard is read from the curve of response. The following relationship then holds:

$$A_1\left\{\begin{matrix}\text{grams test material}\\ \text{calculated to give}\\ \text{the same effect as}\\ \text{the standard}\end{matrix}\right\}\times X\left\{\begin{matrix}\text{units of vitamin}\\ \text{per gram test}\\ \text{material}\end{matrix}\right\}=$$

$$B\left\{\begin{matrix}\text{grams standard}\\ \text{administered}\end{matrix}\right\}\times Y\left\{\begin{matrix}\text{units per gram}\\ \text{standard}\end{matrix}\right\}$$

or

$$X\left\{\begin{matrix}\text{units vitamin per}\\ \text{gram test material}\end{matrix}\right\}=\frac{B}{A_1}\times Y$$

From certain considerations the curve-of-response method is more satisfactory than the curve-of-reference method. In the latter the test material is usually fed at a single level, and there is therefore no way of checking the reliability of the value obtained. In the curve-of-response method, on the other hand, the test material is administered at several levels and the smoothness of the curve is an indication of the validity of the results. This check also has its limitations, since end values used to establish the curve may differ considerably from the true values and yet the curve could be smooth. Any serious deviation may be detected if attention is given to plotting curves of response for successive assays so that they may be superimposed.

Such a collection of curves might serve as the basis of an average curve of response. The accuracy of an assay by either method is increased, of course, if the standard is fed at more than one level.

QUANTITATIVE ASPECTS OF THE VITAMINS IN HUMAN NUTRITION

A survey of the literature reveals some preliminary attempts to estimate quantitatively the vitamin requirements of humans. Brief statements of these approximations are presented here, together with an indication of the premises upon which they have been based. In certain cases these values represent the quantities of a particular vitamin required to alleviate or prevent the symptoms associated with a specific vitamin deficiency. In other cases the estimates are based upon a calculation of the vitamin values of diets which appear to support a satisfactory nutritive state. In a few instances, attempts have been made to determine the vitamin requirements of humans experimentally by means of vitamin-balance studies. Undoubtedly these requirements are influenced by many factors such as age, weight, growth, pregnancy, accompanying diet, metabolic rate, and the presence or absence of disease. Knowledge now available does not permit a precise evaluation of the influence of these factors. For the present, therefore, the values suggested must be considered as rough approximations to be used only as general indications of the vitamin requirements of man.

VITAMIN A

One of the functions of vitamin A is concerned with the regeneration in the retina of the eye of a pigment, rhodopsin (visual purple), which is necessary for normal vision. Rhodopsin is constantly being inactivated (bleached) by light. In the absence of adequate amounts of vitamin A, its regeneration is retarded and nyctalopia, or night blindness, results. This condition has long been recognized as one of the characteristic symptoms of vitamin A deficiency, although as yet there is no evidence that freedom from night blindness necessarily means that the subject is receiving optimal amounts of vitamin A. Nyctalopia is not ordinarily detected except in the advanced stages. Jeans and Zentmire (*360*, *361*), however, have developed a method for measuring low-grade symptoms of night blindness as the basis for detecting faulty vitamin A nutrition. It involves the use of a special photometer to determine an individual's sensitivity to light after a period of dark adaptation. From an examination of 404 school children 6 to 15 years of age, Jeans and Zentmire (*361*) were able to detect poor dark adaptation in 26 percent of the rural group and in 53 percent of the village group. Administration of halibut-liver oil and carotene in oil equivalent to the vitamin A content of 3 teaspoons of cod-liver oil (approximately 9,500 International Units) daily induced recovery in the great majority of the children within a month.

In 1934 the Committee on Nutritional Problems of the American Public Health Association (*14*) concluded from a review of various studies that either 24 ounces of human milk of the highest vitamin A potency or 2 g of average-grade cod-liver oil per day was sufficient to meet the vitamin A requirements of infants. On this basis the committee stated that for infants 1,500 International Units of vitamin A appeared to be about the daily minimum requirement. They thought

that the larger child and adult should probably have more, but felt that they had no sound basis for any definite recommendation for these groups.

Based on evaluations of dietaries upon which good health had been maintained over long periods and allowing for some margin of safety, Rose (*605*) has estimated the following daily vitamin A requirements for different age groups: 2,300 Sherman units or approximately 200 units per 100 calories for the infant; 3,000 units for the 1-year-old; 300 units per 100 calories, or approximately 6,000 to 7,000 Sherman units, for the nursery-school child; roughly 7,000 units for the 9-year-old boy; somewhat over 10,000 units for the high-school boy; about 5,600 Sherman units for the high-school girl; and approximately 100 units per 100 calories, or 3,000 Sherman units, for the adult. On the basis of conversion factors which have been offered, Rose's estimation of the daily requirement for the adult could be expressed by values as low as 1,500 and as high as 4,200 International Units.

In a recent report of Guilbert and Hart (*259*) experimental evidence indicates that the vitamin A requirement is related to body weight rather than to energy requirement. It was found that for mammals (cows) the minimum requirement was of the order of 20 to 30 micrograms of vitamin A or carotene (approximately 30 to 50 International Units) daily per kilogram of body weight. These experiments indicate that in attempting to establish more adequately the vitamin A requirement of man, the significance of body weight should be investigated.

The Council on Pharmacy and Chemistry of the American Medical Association has recently ruled (*12*) that cod-liver oil and preparations made by the addition of therapeutically indifferent substances to the untreated oil may be advertised to the public if the prescribed daily dose provides at least 6,250 International Units of vitamin A and 625 International Units of vitamin D. These are the respective numbers of units provided by 2 teaspoons of cod-liver oil complying with the standards of New and Nonofficial Remedies.

An analysis [8] has been made of many weekly dietary records obtained in 1934–36 from employed wage-earning families in different urban localities in the United States. The families whose diets provided at least the average "minimum requirements" for protein, calcium, phosphorus, iron, and calories usually received 6,000 or more Sherman units of vitamin A per adult per day. For lack of a more precisely determined value, this allowance of vitamin A for adults is being used tentatively by the Bureau of Home Economics in appraising the adequacy of diets with respect to vitamin A.

In summarizing the various allowances of vitamin A that have been suggested for humans, a value of 1,500 International Units per day has been indicated as "the minimum requirement" for infants, while a range of approximately 2,000 to 2,500 International Units per day appears to be a suitable allowance for the infant. Dietary studies show that diets which meet average minimum requirements in other respects furnish in the neighborhood of from 3,000 to 6,000 International Units of vitamin A per day to adults.

[8] Made by Hazel K. Stiebeling, U. S. Bureau of Home Economics, as part of a project under the Works Progress Administration. The field work associated with these studies was supervised by the U. S. Bureau of Labor Statistics.

VITAMIN B

Clinical tests based on balance studies have been proposed by several investigators in an effort to determine the vitamin B status of an individual. In a preliminary study Helmer (*297*) showed that the urine of a normal subject contains demonstrable amounts of vitamin B. At the time he made this report, Helmer was continuing his work with a series of balance studies on normal and diseased subjects.

An extensive study of the daily excretion of vitamin B in the urine has been made by Harris and Leong (*274*). The bradycardia method of determining vitamin B was used. The results showed that healthy adults, varying in age from 17 to 37 years, on normal diets excrete daily 12 to 35 International Units or 30 to 90γ of vitamin B hydrochloride, or approximately 5 to 8 percent of the daily intake of vitamin B. From this it was concluded that an output of vitamin B in urine below 12 International Units per day, or approximately 1 International Unit per 100 cc, should be considered as evidence for strongly questioning the adequacy of vitamin B in the diet. For children, the average total daily output of vitamin B calculated on the basis of body weight was of the same order as for adults, or perhaps higher for the better nourished children. As a result of these studies the minimum standard allowance of vitamin B for a 140-pound man was placed at 200 International Units.

Early attempts of Osborne and Mendel (*552*) to correlate animal size with vitamin B requirement showed that there is probably a gradual increase in vitamin B requirement with increase in body size. It is now known from experiments such as those of Cowgill (*134*) and Williams and coworkers (*736*) that vitamin B plays an important part in carbohydrate metabolism and that the vitamin B requirement is related to the calorie intake of the individual.

Cowgill (*134*) has made a comprehensive study of the vitamin B requirement of man. He first determined the minimum vitamin B requirement of the rat, mouse, pigeon, and dog. From these data he was able to show a correlation between vitamin requirement per unit of body weight and metabolism. He proposed the following general expression relating vitamin requirement to calorie intake and body weight:

$$\frac{\text{Vitamin (daily requirement vitamin B)}}{\text{Calorie (daily total energy exchange)}} = K\ \text{(species constant)} \times W\ \text{(body weight in grams)}$$

Vitamin B is expressed in milligram equivalents (1 International Unit=20 milligram equivalents) and K=0.0000284 for the human species.

This formula was checked by a study of the vitamin B content of numerous human dietaries, some of which were known to have permitted the occurrence of beriberi and others of which were known to have been unassociated with the disease. It was found that the theoretical predictions of the formula for the adequacy of vitamin B intake of these cases were in excellent agreement with the known existing facts.

In order to bring the vitamin B values of foods worked out by different investigators to the same basis for comparison, Cowgill

reduced all units to milligram equivalents of his standard test powder. He pointed out that for complete protection the $\frac{\text{vitamin}}{\text{calorie}}$ ratio must be more than 2. On the assumption that a ratio of 2.5 insures a liberal allowance, the vitamin requirement would be 250 mg equivalents per 100 calories. Cowgill reported 1 Sherman unit, presumably the maintenance unit, equal to 5 mg equivalents. Since one Sherman-Chase unit has been found in this laboratory to approximate 2 maintenance units, 25 Sherman-Chase units per 100 calories would be required for a $\frac{\text{vitamin}}{\text{calorie}}$ ratio of 2.5. According to Cowgill's estimate of 1 International Unit per 20 mg equivalents, this ratio indicates a requirement of 12 International Units per 100 calories. On this basis the average daily vitamin B requirement of an adult with an intake of 2,500 to 3,000 calories would be 625 to 750 Sherman units or 300 to 375 International Units. Since these values are based on a $\frac{\text{vitamin}}{\text{calorie}}$ ratio of 2.5 rather than 2, they represent more than a minimum requirement. It is Cowgill's belief that border-line cases of beriberi are far more prevalent than most persons realize, which indicates that vitamin B requirements are not being met as universally as is supposed.

From a study of reports made by a number of investigators Rose (*605*) recommends a daily intake of 30 Sherman-Chase units per 100 calories as a liberal allowance. For the average adult this would mean between 750 and 900 Sherman-Chase units, or roughly 250 to 400 International Units per day, quantities admittedly well above the minimum requirement.

Recent analyses by Baker and Wright (*32*) of large numbers of dietaries from regions where beriberi is prevalent showed that the vitamin B content of the diet fell in the range of 71 to 180 International Units per day. Protective diets might vary from 145 to 500 International Units, depending on the weight of the individual. A diet possible for the typical workingman receiving a fair income contained 440 units of vitamin B for 3,060 calories. Analyses of diets recommended as suitable revealed for the "bare" or "skeleton" ration a vitamin B content of approximately 212 to 343 International Units and for the "high" diets values ranging from 700 to 1,000 International Units per day.

With reference to the vitamin B requirement of children, Baker and Wright emphasize the fact that Cowgill's formula applies to adults, and there is evidence that children need relatively more vitamin B on the basis of calorie intake. The diet recommended by the Ministry of Health's advisory committee for Great Britain's Poor Law Children's Homes contains 450 International Units per child for about 2,700 calories.

The vitamin B intake of the normal adult has been calculated as approximately 1 mg daily by Vorhaus, Williams, and Waterman (*709*), who are most reluctant to give a definite requirement figure "unless every component of the diet is fixed and well-defined standards of function are specified." Salter (*626*) indicated that 0.5 mg of crystalline vitamin B appeared to approach the average requirement value. These two estimates represent roughly about 250 and 125 Interna-

tional Units, respectively. In view of other suggestions based upon more recent work, it would seem that Salter's figure is low.

In 1934 the Committee on Nutritional Problems of the American Public Health Association (*14*) recommended approximately 200 International Units of vitamin B as more than the minimum requirement for the adult man.

The Council on Pharmacy and Chemistry of the American Medical Association (*12*) in their 1936 report states:

> In the light of present knowledge the daily requirement for vitamin B_1 appears to be not less than 50 units (International) for the infant and 200 units (International) for the adult.

In order to be acceptable according to the standards for New and Nonofficial Remedies, foods advertised as noteworthy medicinal sources of vitamin B must provide in the quantity of food consumed daily at least 200 International Units for the adult.

Rose feels that pregnant women should have double the quantity of vitamin B required by the normal adult, while nursing mothers should receive triple this amount. Baker and Wright recommend an intake during pregnancy of three to five times the normal requirement.

The dietary records of the employed wage-earning families in different urban communities in the United States (p. 19) were also evaluated in terms of average vitamin B intake. When the diets of these families provided at least the "minimum daily requirements" for protein, calcium, phosphorus, iron, and calories, they usually provided as well around 600 Sherman-Chase units (approximately 200 to 300 International Units) of vitamin B per adult per day. This is being used as a very tentative standard by the Bureau of Home Economics for purposes of evaluating the adequacy of diets with respect to vitamin B.

In general most investigators agree that the vitamin B requirement is directly associated with the calorie intake. There is evidence that the adult needs at least 10 International Units per 100 calories to meet minimum requirements and probably in the neighborhood of one and one-half or twice this amount to furnish a liberal allowance. There are also indications that the rapidly growing and well-nourished child may require relatively more vitamin B per 100 calorie intake than the adult. Various dietary studies in both the United States and Great Britain have shown that adults receiving adequate diets in other respects were ingesting approximately 300 to 400 International Units of vitamin B per person per day.

VITAMIN C

Measurement of capillary resistance and the determination of ascorbic acid excretion in the urine have been suggested as means for determining the state of vitamin C nutrition of an individual.

Measuring the strength of the skin capillaries is not a new test, but one which has been used for a long time in a number of diseased conditions. Hess and Fish (*303*) and Hess (*299*) used this test and found marked improvement in the capillary strength of children suffering from scurvy after the ingestion of foods rich in vitamin C. A quantitative modification and development of the method was made by Göthlin (*246*), who measured not only various degrees of scurvy but also low standards of vitamin C nutrition in which clinical symptoms were not apparent.

Göthlin employed an ordinary arm band used to determine blood pressure for measuring capillary fragility, although more recently both the pressure and suction type of instruments (*146*) have been described for this purpose. After subjecting the capillaries and venules of the arm to an increased intravascular pressure, 35 to 50 mm, for a period of 15 minutes, he noted in a small marked area inside of the elbow any rupture of the capillaries due to this increased strain. The pressure applied should always be below the diastolic pressure of the subject, in order not to obstruct the afflux of arterial blood. Göthlin proposed a system of scoring based on the number of petechiae occurring in the test area. He (*247*) recommends an intake of 0.7 to 1.0 cc of orange juice daily per kilogram of body weight. This would be approximately 50 cc of orange juice or 19 to 27 mg (380 to 540 International Units) of ascorbic acid per day for a 60-kg man.

By means of the capillary fragility test, Stocking (*674*) and Dalldorf and Russell (*148*) have substantiated Göthlin's observations and have indicated the suitability of the test for clinical use. Other investigators (*2, 289*), however, have been unable to obtain consistent results. While single tests may not give reliable results, a series of measurements made over a period of time and showing marked increases in capillary resistance with increased vitamin C intake are of distinctly greater value. Dalldorf emphasizes the importance of using the test in this way.

More recently chemical analysis of the urine for ascorbic acid has been used extensively and appears to offer a more promising means of detecting the existence of vitamin C subnutrition. However, difficulties which exist in making the test strictly quantitative for ascorbic acid still prevent the method from being a completely satisfactory one.

Using this method Harris and coworkers (*278, 279*) and Abbasy, Harris, Ray, and Marrack (*3*) showed that children suffering from mild or severe scurvy tend to excrete less vitamin C than do well-nourished children of the same age. Under normal conditions, an adult (140-pound man) on an adequate intake of vitamin C will excrete approximately 20 mg of ascorbic acid daily in the urine. On the basis of body weight, the results with children are well in line with those for adults. A 14-pound infant will have a normal daily excretion of about 2 mg of ascorbic acid. In a normal subject, a large dose of vitamin C (100 mg at age of weaning and 700 mg for a 140-pound man) causes a sharp peak in urinary ascorbic acid, which suggests that an adequate reserve supply of the vitamin exists in the tissues and that the surplus is eliminated by way of the urine. Withholding vitamin C from a normal subject does not lower the quantity of vitamin C excreted in the urine until after several days have elapsed. On the other hand, these investigators showed that if a large dose of vitamin C is administered to an individual who for a period of time has been receiving a subminimal quantity of this vitamin in the diet, there will be considerably less response in the urinary excretion. It may take the administration of large doses for several days before the tissues become saturated and a sharp peak in excretion occurs.

Abbasy, Harris, and coworkers found that 45 mg of ascorbic acid, the quantity supplied by approximately 1½ oranges given daily for a period of 3 weeks, raised the excretion of vitamin C to about 32 mg per day, while 15 mg of ascorbic acid caused a constant excretion of 15 mg daily. They showed that persons excreting less than

15 mg of vitamin C daily were receiving only border-line protection. From their experiments it would seem that a daily intake of 15 mg (300 International Units) of ascorbic acid would cover minimum requirements with very little margin of safety.

In accordance with Harris and coworkers, Hess and Benjamin (*301*) and Harde and coworkers (*270*) found that in certain cases it was possible to have a hypovitaminosis even though the excretion of vitamin C in the urine was within normal limits. An excessive intake of vitamin C would not cause an immediate peak in the urinary excretion of this vitamin in these cases, since increased excretion of vitamin C takes place only after bodily needs have been supplied.

Hawley and coworkers (*289*) found such large individual variations in the ascorbic acid excretion of normal subjects that they questioned the validity of the test. They (*288*) reported that ascorbic acid content could be correlated with the pH of the urine.

Scurvy is comparatively rare in breast-fed infants. Harris and Ray (*278*) found that human milk contains three to four times as much vitamin C as cows' milk taken directly from the udder. Selleg and King (*639*) reported that average market milk contains in the neighborhood of 0.01 mg of ascorbic acid per cubic centimeter, and found that human milk from mothers on normal diets contained approximately 0.055 to 0.064 mg of ascorbic acid per cubic centimeter. These workers calculated that the vitamin C intake for a normal infant is approximately 40 to 50 mg of ascorbic acid (800 to 1,000 International Units) per day for the first few weeks of life. Neuweiler (*547*) found the vitamin C requirement of pregnant women to be greater than that of nonpregnant women, while the requirement of women during the lactation period is greatest of all.

Rose (*605*) suggests that 7 Sherman units of vitamin C will protect an infant from scurvy. However, she recommends three times this amount as a liberal allowance during approximately the first 10 years of childhood, or so long as the calorie intake remains below 2,000 calories per day. For the older child she recommends a dietary standard of 1 Sherman unit per 100 calories to provide for "added requirements of growth and activity" and for the adult, 30 Sherman units. This would correspond roughly to 300 to 450 International Units per adult per day.

Szent-Györgyi (*685*) estimated the effective daily dose of vitamin C for an infant at 25 mg, while Salter (*626*) suggested tentatively 35 mg. In terms of International Units this is approximately 500 and 700, respectively.

In an attempt to determine the vitamin C needs of young children of preschool age, Everson and Daniels (*213*) found that the daily ingestion of approximately 7.5 mg of ascorbic acid per kilogram of body weight induced maximum retention of this vitamin. For a 17-kg child this level of intake would correspond to 128 mg of ascorbic acid or to about 2,500 International Units of vitamin C per day.

The Committee on Nutritional Problems of the American Public Health Association (*14*) in 1934 estimated that 100 International Units of vitamin C, equivalent to approximately 10 cc of orange juice, will protect an infant from scurvy. They calculated that approximately 300 International Units would be necessary for an adult.

Recently the Council on Pharmacy and Chemistry of the American Medical Association (*12*) has indicated that the claim for a product as a valuable source of vitamin C "should be permitted only if it provides a daily intake of at least 250 units" (International) of vitamin C.

Dann and Cowgill (*152*) found the factor of metabolic rate to be insignificant in determining vitamin C requirement.

The weekly dietary records of a large group of employed wage-earning families living in urban communities in the United States (pp. 19 and 22) were recently summarized in terms of the different essential nutrients consumed per adult. Diets which provided at least the "minimum daily requirements" for calories, protein, calcium, phosphorus, and iron usually provided about 150 Sherman units (roughly 1,500 International Units) of vitamin C also. The vitamin C intake was computed using the vitamin C values for uncooked foods, so that this estimate does not take into account any losses that may have taken place during cooking. This allowance of vitamin C is being used tentatively by the Bureau of Home Economics in appraising the adequacy of diets with respect to vitamin C.

In summarizing the various estimates for vitamin C requirements, the indication is that 100 to 200 International Units per day will protect an infant from scurvy. The normal breast-fed infant probably receives approximately 800 to 1,000 International Units daily for the first few weeks of life. Vitamin C-balance studies on the preschool child suggest that around 2,000 to 3,000 International Units per day may be required for rapid growth and for maximum retention of vitamin C. The estimates for the adult range from 300 International Units, suggested as a minimum requirement, to an allowance of about 1,500 International Units, computed from dietary surveys on the basis of the vitamin C content of the uncooked foods.

VITAMIN D

In the past the diagnostic signs of vitamin D deficiency indicated by rickets and determined by physical examination, X-ray study of long bones, or the chemical analysis of the blood serum for phosphorus, have all been used. The results have not been interpreted in the same way nor the findings expressed in the same terms by different investigators. Kay (*384*) observed that in rickets there is a marked rise in blood phosphatase, and during the last 5 years several investigators, among them Bodansky and Jaffe (*65*), Smith (*655*), and Barnes (*35*), have attempted to apply this observation in testing for the presence of rickets. A rise in blood phosphatase may accompany other disorders than rickets and is therefore not a specific test. Clinically, X-ray examination of the long bones is more generally used.

Notwithstanding the extensive work which has already been done to estimate the requirement for vitamin D, there is still lack of general agreement. Much more clinical work will be necessary before adequate information is available.

Evidence presented by Hess and Lewis (*304*) indicates that the human requirement for vitamin D is greatest in infancy and that after the first 2 years the danger of developing rickets is greatly diminished. Drake, Tisdall, and Brown (*175*) found that the more slowly growing infants are less susceptible than those growing more rapidly than normal. The Council on Pharmacy and Chemistry of the American Medical Association (*12*) states that there is no tangible evidence on

the actual vitamin D requirement of the adult, although it appears that the requirement is increased during pregnancy and lactation. For rulings made by the council concerning the vitamin D potency of preparations which may be advertised to the public see page 19.

A minimum daily requirement of approximately 450 U. S. P. units for an infant was suggested by Barnes, Brady, and James (*36*). The Children's Bureau of the United States Department of Labor (*704*) recommended one-half teaspoon of cod-liver oil twice daily for infants 2 to 3 weeks old, 1 teaspoon twice a day during the second month, and 1½ to 2 teaspoons daily for infants of over 3 months. Hess and Lewis (*304*) placed the minimum protective dose of cod-liver oil for the infant at 250 Steenbock units. This dose would correspond to about 750 International Units. Drake, Tisdall, and Brown (*175*) found that 1 teaspoon of cod-liver oil, estimated at 130 Steenbock units, or approximately 400 International Units, was sufficient in most cases for the prevention of rickets. Barnes (*35*), however, was unsuccessful in obtaining protection when administering a dose as small as that indicated by Drake.

Many physicians advise 2 teaspoons of high-grade cod-liver oil (corresponding to at least 700 to 800 International Units) as a prophylactic dose for the infant. Harris (*272*) provisionally recommended 1,500 International Units of vitamin D for ordinary prophylactic use.

In 1933 Hess and Lewis (*304*) indicated that the same number of "rat units" of vitamin D from different sources did not offer the same protective or curative effect (p. 8).

Eliot, Nelson, and coworkers (*202*) in an extensive clinical study compared the efficacy of cod-liver oil, viosterol, and vitamin D enriched milks in preventing rickets as indicated by X-ray examination. They came to the conclusion that under comparable conditions, 675 units of vitamin D as irradiated ergosterol were just as effective in preventing rickets as 675 units of vitamin D administered in the form of cod-liver oil. These authors reported a few cases of slight rickets in infants receiving 675 International Units, a dose which they believe to be near the minimum protective level.

On the other hand, Jeans (*359*) reports that milk enriched with animal-source vitamin D containing 135 International Units per quart furnishes about the minimum level effective in preventing rickets. However, Jeans particularly emphasizes that prevention of rickets is no criterion of the adequacy of vitamin D intake. He recognizes that the vitamin D requirement must provide for "best growth and suitable calcium retention" in addition to prevention of rickets. Four hundred International Units of animal-source vitamin D, supplied as vitamin D milk or cod-liver oil, were found to meet these requirements, although his observations have not yet indicated how much in excess this may be of the minimum requirement. Based on clinical evidence, Jeans states that vitamin D of animal origin appears to be roughly about one and one-half times more potent for the human being than the vitamin D of vegetable source.

The Nutrition Committee of the League of Nations Health Organisation (*89*) indicated that the vitamin D requirement depends on the form in which vitamin D is given. The committee further suggested that allowances of vitamin D be increased when the diet is deficient in calcium, when it contains much cereal, and when little

sunlight is available. There are few natural food sources of vitamin D. Exposure to direct sunlight is a substitute for vitamin D therapy and is to be preferred when adequate sunlight is available.

The results of various empirical estimates and judgments based on experimental evidence indicate lack of agreement concerning the vitamin D requirement of the infant. Different workers have reported values as low as 135 International Units and as high as 675 International Units of Vitamin D as the approximate minimum requirement necessary to prevent rickets. On the other hand, a quantity of vitamin D milk or cod-liver oil containing 400 International Units of vitamin D was reported to be adequate for best growth and suitable calcium retention in addition to the prevention of rickets. Many physicians recommend the use of 2 teaspoons of cod-liver oil which contain roughly 700 to 800 International Units as a prophylactic dose.

VITAMIN E

Vitamin E has not yet been sufficiently identified to enable even the crudest of requirement studies to be made. The American Public Health Association committee (*14*) concluded that if vitamin E is required, it apparently is adequately supplied in our dietaries and need not be a matter of particular concern. Recently the Council on Pharmacy and Chemistry of the American Medical Association (*12*) found "no evidence to indicate that vitamin E has therapeutic merit."

VITAMIN G

Vitamin G has been shown to be essential for the growth of small experimental animals and in association with a protein to form an oxidation-reduction enzyme of living cells. When methods for determining and isolating the various factors of the vitamin B complex have been more adequately worked out, it will be possible to carry out balance studies as suggested by Helmer (*297*) and in a rough way make certain estimations concerning the human requirements of each.

The vitamin G intake has been estimated from the dietary records of employed wage-earning families in different urban communities in the United States (p. 19). Diets which supplied at least the "minimum daily requirements" for calories, protein, calcium, phosphorus, and iron usually carried about 600 Bourquin-Sherman units of vitamin G per adult per day. For lack of any more acceptable standards, a daily allowance of 600 units of vitamin G for adults is being used tentatively by the Bureau of Home Economics in appraising the adequacy of diets with respect to vitamin G.

PELLAGRA-PREVENTING VITAMIN

Until more is known about the factor or factors preventing pellagra, very little can be said about the requirement for this vitamin.

Dried yeast is the richest known source of the pellagra-preventing (P–P) vitamin. According to Walker and Wheeler (*710*) 30 g of dried yeast daily is probably the smallest amount which will provide protection against pellagra. Sebrell (*637*) compiled a list of all foods that have been thoroughly tested for their pellagra-preventing properties, and indicated the relative value of each in preventing this disease.

Stiebeling and Munsell (*673*) found that families using on the average 2¼ cups of milk, 3 ounces of fruit and succulent vegetables, and about 3 ounces of lean meat per person per day were free from pellagra. On the basis of this study Rose (*605*) recommends, to prevent pellagra, a diet containing daily a pint of milk for every adult and a quart for every growing child, supplemented by fruits and vegetables in generous quantities.

TABULAR DATA ON THE VITAMIN CONTENT OF FOODS

Studies to determine the value of foods as sources of a given vitamin have generally been initiated soon after the vitamin was discovered and considerable information on the occurrence of vitamins in foods has accumulated during the last 20 to 25 years. The principal object of this bulletin is to bring this material together in a concise and usable form.

All likely source material up to January 1, 1936, has been carefully searched and any data on the vitamin A, B, C, D, and G content of foods that could in any sense be considered quantitative have been scrutinized and evaluated. This material is summarized in table 1. Considerable unpublished data from State agricultural experiment stations and other laboratories where vitamin studies are under way are also included. Values for vitamin E are not given, since no unit has been generally accepted for this vitamin and therefore data could not be interpreted in a quantitative sense. Vitamin E seems to be widely distributed in natural food products, and even if an essential constituent of the human dietary, there is small chance of selecting a diet deficient in this vitamin. Vitamin G values as explained in the discussion of the chemistry of this vitamin may for the most part be accepted as essentially measures of growth-promoting flavin.

At the time plans were drawn for this summary of quantitative vitamin data, serious consideration was given to the question of units to be used. It was realized that in the future the International Units would probably be generally accepted for expressing vitamin potency. However, most of the values reported up to the time of the compilation of these data were expressed in the older units, the majority in Sherman units. Factors for converting these into International Units cannot be satisfactorily determined (p. 12). In view of these facts it seemed better, therefore, when values were not reported as International Units, to express those for vitamins A, B, C, and G in Sherman units and vitamin D in A. D. M. A. units. When it was necessary to interpret data in order to evaluate the results in the desired units, every effort was made to do this consistently and logically.

In summarizing the material in tabular form every attempt was made to list the individual foods so that the item sought could be located easily. Under each food the values available for the whole product are given first in the following order: Fresh, fresh stored, frozen, frozen stored, dried, dried stored, and so on. Values for parts of vegetables and fruits when reported are given directly after the values for the whole product. The data on cooked or processed foods have been disregarded since presentation of this material did not seem feasible at this time because of the lack of standardized cooking procedures. The values listed may be assumed to apply to the edible portion only.

The description and identification of the food or food product is that given in the report from which the data were taken. In a large majority of cases, however, little information other than the name of the food was given. It was often almost impossible, for instance, to determine whether vegetables or fruits were peeled before testing, whether the juice of fruits or the flesh was used, whether the seeds of fruits were removed before feeding, and many other facts which, if they had been available, would have added to the significance of the data. If investigators whose reports are included in this compilation would supply the authors with such missing data, future editions of this bulletin could be made more useful.

Since the time of identification of vitamin C as ascorbic acid, considerable information has accumulated on the ascorbic acid content of foods. These determinations have been made chemically, and it seemed better to report them by weight of pure vitamin as the investigators have done than to interpret this quantity in terms of biological response. The ascorbic acid data are accordingly summarized in table 2.

To meet the needs of workers requiring single values for use in planning or analyzing diets, there is an abridged table of the more common foods (table 3). These values are not averages but were derived by a careful consideration of the data, the source, and the method of determination, and represent the best judgment of the authors.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods* [1]

Food	Description given by investigator [2]	Vitamin A	Vitamin B [3]	Vitamin C	Vitamin D	Vitamin G [4]	Year reported	Investigator
Alfalfa (*Medicago sativa*):								
Fresh		26,900±1,700 [5]					1935	Woods, Atkeson, Shaw, Slater, and Johnson (*755*).
		17,500±1,400						
Alfalfa leaves:								
Fresh		4×commercially dehydrated.					1934	Guilbert (*257*).
	Lucerne Provence, Chinese, and Hunter's River varieties.	330-400					1935	Levy and Fox (*448*).
Dried		2,500					1934	Fraps, Copeland, and Treichler (*230*).
	Field cured	[1,740]					1929	Russell (*610*).
	Machine dried	4,000					1934	Fraps, Copeland, and Treichler (*230*).
	do	5,000-6,660					1933	Fraps and Treichler (*234*).
	do	[14,300]			0		1929	Russell (*610*).
	do	8,000					1934	Sherwood and Fraps (*650*).
	do	5,500						
	Commercially dehydrated	Much>10,000					1934	Guilbert (*257*).
	Dried indoors in sunlight	[1,580]			[9]		1929	Russell (*610*).
	Dried indoors without sunlight				[9]			
	Vacuum dried 3 hours at 100° C	Same as fresh					1934	Guilbert (*257*).
Dried and stored	5 months, room temperature	72 percent fresh						
	8 months	80 percent fresh					1933	Fraps and Treichler (*234*).
	11 months	50 percent fresh						
Almond (*Amygdalus communis*).			80 (Int.) [6]				1935	Baker and Wright (*31*).
			[100]				1929	Plimmer, Raymond, and Lowndes (*562*).
Almond oil		0					1923	Morgan, Newbecker, and Bridge (*523*).
		0					1914	Osborne and Mendel (*553*).
Apple (*Malus sylvestris*):	American varieties:							
				10			1922	Givens, McCluggage, and Van Horne (*244*).
	Astrachan			12			1934	Smith and Fellers (*654*).
	Baldwin			25			1933	Fellers, Cleveland, and Clague (*219*).
	do			25			1934	Smith and Fellers (*654*).
	do		7-8 *	Slightly<10		16	(8)	Cornell University (Spohn, Becker, et al.).
	Delicious			4-5			1934	Batchelder (*39*).
	do	84	10 *	9			1934	Manville, McMinis, and Chuinard (*477*).

----do			4–5			1934	Batchelder (*40*).
Delicious, cored and peeled					20	1933	Day and Darby (*160*).
Gravenstein			9			1934	Smith and Fellers (*654*).
Jonathan			Slightly<5			1929	Hessler and Craig (*320*).
----do			4–5			1934	Batchelder (*40*).
McIntosh			2–4			1932	Fellers, Isham, and Smith (*222*).
----do			4			1934	Smith and Fellers (*654*).
Northern Spy		7 *	Slightly<10		10	(8)	Cornell University (Spohn, Becker, et al.).
Rome Beauty	42	16 *	9			1934	Manville, McMinis, and Chuinard (*477*).
Stayman [Stayman Winesap]	60	<7 *	9				
Wealthy			8			1934	Smith and Fellers (*654*).
Winesap	91	7 *	9			1934	Manville, McMinis, and Chuinard (*477*).
----do			10			1933	Potter (*571*).
Winesap, from fertilized trees			>Nonfertilized			1933	Potter and Overholser (*573*).
Yellow Newtown	119	7 *	21			1934	Manville, McMinis, and Chuinard (*477*).
English varieties:							
Baldwin			5			1932	Crane and Zilva (*137*).
Belle de Boskoop			20				
Blenheim Orange			5–10				
Bramley's Seedling			20–33			1930	Bracewell, Hoyle, and Zilva (*74*).
----do			20–33			1932	Crane and Zilva (*137*).
Bramley's Seedling, unpeeled			3–5 (Int.)			1934	Zilva and Morris (*771*).
Cox's Orange Pippin			5–10			1931	Bracewell, Kidd, West, and Zilva (*75*).
----do			5–10			1930	Bracewell, Hoyle, and Zilva (*74*).
----do			Slightly<5			1932	Crane and Zilva (*137*).
Dabinette			14			1930	Bracewell, Hoyle, and Zilva (*74*).
Gennet Moyle			10–20			1932	Crane and Zilva (*137*).
Gravenstein			<5				
King Edward VII			<5			1930	Bracewell, Hoyle, and Zilva (*74*).
----do			Slightly<5			1932	Crane and Zilva (*137*).
----do			5			1933	Wallace and Zilva (*711*).
Lane's Prince Albert			10–20			1932	Crane and Zilva (*137*).
----do			14			1931	Zilva, Kidd, and West (*768*).
Newton Wonder			10			1931	Bracewell, Kidd, West, and Zilva (*75*).
----do			10			1932	Crane and Zilva (*137*).
----do			5			1931	Zilva, Kidd, and West (*768*).
Reinette du Canada			Slightly<10			1932	Crane and Zilva (*137*).
Ribston			5–10				
Warner's King			5–10				
Woodbine			Slightly<5			1930	Bracewell, Hoyle, and Zilva (*74*).
Worcester Pearmain			----do				
----do			<5			1932	Crane and Zilva (*137*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Apple—Continued	English varieties—Continued.							
	Undifferentiated		40 (Int.) [6]				1935	Baker and Wright (*31*).
	do		[27]			[19]	1931	Roscoe (*603*).
	European varieties:							
	August			17			1931	Von Hahn (*263*).
	Baumann's Rennet			10				
	Bellefleur de Brabant			5			1930	Van Leersum and Hoogenboom (*445*).
	Bohn			20			1934	Krauss (*415*).
	Boskoop, peeled and cored			>10–<33				
	Jonathan			<20			1931	Von Hahn (*263*).
	Red Cheeked Rennet			10				
	Russian varieties			6–20			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	Antonovka			33				
	Yellow Parmänen [Golden Pearmain?].			20				
Stored	50 days, Gravenstein			10			1934	Krauss (*415*).
	More than 50 days, Gravenstein			<10				
	2 months, Ben Davis			16				
	2 months, Delicious			4				
	2 months, Golden Delicious			6				
	2 months, Northern Spy			20				
	2 months, Rhode Island [Rhode Island Greening].			11				
	2 months, Esopus Spitzenberg			14				
	3½ months, Arkansas			9				
	2½ months, Cortland			8				
	2½ months, Jonathan			6			1934	Smith and Fellers (*654*).
	2½ months, King [Tompkins King]			11				
	2½ months, King David			6				
	2½ months, Roxbury [Roxbury Russet].			11				
	3 months, Rome [Rome Beauty]			13				
	3 months, Stayman [Stayman Winesap].			11				
	3 months, Tolman [Tolman Sweet]			5				
	3 months, Winesap			15				
	3 months, 1° C., English varieties			90 percent fresh			1930	Bracewell, Hoyle, and Zilva (*74*).
	3 to 5 months, 10° C., English varieties.			60 percent fresh				
	3 to 5 months, 10° C., Jonathan			50–60 percent fresh			1929	Hessler and Craig (*320*).
	3 months, 45° F., Delicious			83 percent or more of fresh.			1934	Batchelder (*40*).
	3 months, 45° F., cellar, Delicious			3			1934	Batchelder (*39*).

	3½ months, Golden Delicious, cored and peeled.	[100]					1933	Potter (*670*).
	3½ months, Red Delicious, cored and peeled.	[50]						
	3½ months, McIntosh, cored and peeled.	[105]						
	4 to 6 months, 36° F., Baldwin			80 percent fresh			1933	Fellers, Cleveland, and Clague (*219*).
	6 months, 32° F., Delicious			Same as fresh			1934	Batchelder (*40*).
	6 months, 45° F., Delicious			75 percent fresh				
	6 months, 45° F., cellar, Delicious			<3			1934	Batchelder (*39*).
	6 months, 32° F., Jonathan			>Stored 45° F			1934	Batchelder (*41*).
	8 to 10 months, 36° F., Baldwin			60 percent fresh			1933	Fellers, Cleveland, and Clague (*219*).
	Fall, winter, spring, 32° F., commercial cold storage, Delicious.			4			1934	Batchelder (*39*).
	Winter, 1 to 4° C., Bellefleur de Brabant.			Same as fresh			1930	Van Leersum and Hoogenboom (*445*).
	Winter to spring, tested at intervals			Gradual loss to 0			1932	Pelc and Podzimková (*556*).
	Until May, Yellow Parmänen [Golden Pearman?].			20			1934	Krauss (*415*).
	1 year, cold storage, Bohn			20				
	March tested, Winesap			33 percent fresh			1924	Kohman, Eddy, and Carlsson (*402*).
	New York market	50					1924	Munsell (*529*).
Frozen	−20° C., Bramley's Seedling			Same as fresh			1933	Zilva, Kidd, and West (*769*).
	Bramley Seedling:							
Frozen and stored	−5° C., 3 months			0			1934	Zilva, Kidd, and West (*770*).
	−5° C., 7 months			<50 percent fresh			1933	Zilva, Kidd, and West (*769*).
	−10° C., 3 months			30 percent fresh			1934	Zilva, Kidd, and West (*770*).
	−10° C., 6 months			<30 percent fresh				
	−10° C., 7 months			50 percent fresh				
	−15° C., 7 months			Slightly<fresh			1933	Zilva, Kidd, and West (*769*).
	−20° C., 7 months			Same as fresh				
	−20° C., 14 months			Slightly<fresh				
	In vacuum, −5° C			75 percent fresh			1934	Zilva, Kidd, and West (*770*).
	In vacuum, −10° C			do				
	In vacuum, −20° C			Same as fresh				
Dried				<30			1922	Givens, McCluggage, and Van Horne (*244*).
	Sulphured "Antonovka"			50			1934	Shivrina and Onokhova (*652*).
Apple flesh	Inner, Bramley's Seedling			10			1931	Bracewell, Kidd, West, and Zilva (*75*).
	Outer, Bramley's Seedling			30				
Stored	Inner, Baldwin apples stored from October to February.			>12-<25			1932	Fellers, Isham, and Smith (*222*).
	Outer, Baldwin apples stored from October to February.			50				

See footnotes at end of table.

119220°—37——3

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Apple core	Boskoop			<10			1934	Krauss (*415*).
	Bohn			[20]				
Apple peel	Boskoop			33 or more				
	Baldwin			100–200			1932	Fellers, Isham, and Smith (*222*).
	Bramley's Seedling and Newton Wonder.			100			1931	Bracewell, Kidd, West, and Zilva (*75*).
	McIntosh			<50			1932	Fellers, Isham, and Smith (*222*).
Dried				50			1922	Givens, McCluggage, and Van Horne (*244*).
Apple juice:								
Fresh				Same as apples			1933	Fellers, Cleveland, and Clague (*219*).
	Bohn			20			1934	Krauss (*415*).
Stored	38° F., 1 to 7 days, Baldwin, commercial.			Slightly>50 percent fresh apple.			1932	Fellers, Isham, and Smith (*222*).
	1 week			80 percent fresh			(8)	Massachusetts State College (Fellers).
	Cold storage, Gravenstein			Trace			1934	Krauss (*415*).
Pasteurized	Gravenstein			0				
Apricot (*Prunus armeniaca*):								
Frozen	Bienheim		9 (Int.)			42	(8)	University of California (Morgan).
		3,850–6,890		7			1930	Morgan and Field (*514*).
	Kept at −17° C., Royal	[8,570]						
	Container nonevacuated, kept at −17° C., Royal.			0			1931	Morgan, Field, and Nichols (*516*).
	Container evacuated, kept at −17° C., Royal.			[7]				
	do	[8,570]					1930	Morgan and Field (*514*).
	do	[3,230]		[6]			1933	Morgan, Field, and Nichols (*518*).
	Container evacuated, refilled with N twice, −17° C., Royal.	[5,720]					1933	Morgan and Madsen (*522*).
	Container sealed under CO_2, kept at −17° C., Royal.	[4,290]					1933	Smith and Morgan (*656*).
Dried		6,000 (Int.)					(8)	Columbia University (Booher and Williams).
	Sulphured: Dehydrated	10,000–20,000		16–24			(8)	University of California (Morgan).
	do			[21]			1931	Morgan, Field, and Nichols (*516*).

	Dehydrated 30 minutes	[18,230]					1930	Morgan and Field (*514*).
	Dehydrated 3½ hours	[7,790]						
	Sun-dried	5,300–8,820	20 (Int.)	12–24		95	(8)	University of California (Morgan).
	do	[6,860]					1930	Morgan and Field (*514*).
	do			[9]			1931	Morgan, Field, and Nichols (*516*).
	do	17–21 percent fresh					1932	Morgan, Field, and Nichols (*517*).
	do	[13,200–14,310]					1933	Morgan and Madsen (*522*).
	Sun-dried, 17.5 percent water	26–41 percent fresh		94–100 percent fresh			1933	Morgan, Field, and Nichols (*518*).
	Sun-dried, 17.5–19 percent water	17–21 percent fresh						
	Sun-dried and processed	18–20 percent fresh		50 percent fresh				
	do	5,300		10				
	Unsulphured:							
	Dehydrated	5,740		0			(8)	University of California (Morgan).
	do	[5,830–11,830]					1930	Morgan and Field (*514*).
	do			[<7]			1931	Morgan, Field, and Nichols (*516*).
	do	16–26 percent fresh					1932	Morgan, Field, and Nichols (*517*).
	do			0			1933	Morgan, Field, and Nichols (*518*).
	Unsulphured, sun-dried	2,640–6,890	44 (Int.)	0		124	(8)	University of California (Morgan).
	do			[0]			1931	Morgan, Field, and Nichols (*516*).
	do	[13,200–14,310]					1933	Morgan and Madsen (*522*).
	Unsulphured, sun-dried, 14.7 percent water.	18–24 percent fresh		0			1933	Morgan, Field, and Nichols (*518*).
Dried and stored	Sulphured, sun-dried, 17.5 percent water, stored 1 year, room temperature.			40 percent fresh				
Arracacia (*Arracacia xanthorrhiza*).		400					1933	Axtmayer and Cook (*24*).
Artichoke, globe or French (*Cynara scolymus*).		280					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*.)
				18			(8)	Columbia University (Quinn and Hartley). (See Rice and Munsell, 1931.) (*591*.)
Artichoke, Jerusalem.	See Jerusalem-artichoke.							
Asparagus (*Asparagus officinalis*):				25			1931	Von Hahn (*264*).
		250					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*.)
				50			1929	Scheunert (*632*).

See footnotes at end of table

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Asparagus—Contd.	Bleached and green			10			1931	Wasson (*716*).
	Green	1,000					1929	Crist and Dye (*142*).
	do	<1,000					1931	Crist and Dye (*143*).
	do	500–700		40–50			1933	Fellers, Young, and Isham (*225*).
	do			50			1934	Fellers, Young, Isham, and Clague (*226*).
	Bleached	0					1929	Crist and Dye (*142*).
	do	0					1931	Crist and Dye (*143*).
	do			Same as green			1930	South Dakota Agricultural Experiment Station (*740*).
	Fertilized, high nitrogen or high potash.	Approximately same as normal fertilized.		Approximately same as normal fertilized.			1934	Fellers, Young, Isham, and Clague (*226*).
	Frozen			Same as fresh				
Avocado (*Persea* spp.)		500					(8)	Puerto Rico School of Tropical Medicine (Cook).
						55	1933	Day and Darby (*160*).
				[Slightly<20]			1930	Weatherby (*722*).
			[100]*				1928	Weatherby and Waterman (*723*).
		110					1929	Weatherby, Youtz, and Watson (*724*).
Bacon						86	(8)	Columbia University (Douglass).
		0					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*.)
Banana (*Musa sapientum*):		80–275					(8)	Columbia University (Gates).
			[20–30]*				1923	Acuña (*4*).
			50 (Int.)				1935	Baker and Wright (*31*).
						26	(8)	Columbia University (Douglass).
		250	10–50*	20	0	50	1933	Eddy (*195*).
		170–210	<10	17	0		1927	Eddy and Kellogg (*197*).
		200					1933	Fraps and Treichler (*234*).
				10			1922	Givens, McCluggage, and Van Horne (*244*).
				16			1931	Von Hahn (*263*).
		350					(3)	Columbia University (Munsell). (See Rice and Munsell 1931.) (*591*.)
			[54]			[38]	1931	Roscoe (*603*).

Dried				<20			1922	Givens, McCluggage, and Van Horne (*244*).
			58–67			100	1931	Miller and Munsell (*502*).
	Spray process	1,000	40–200	5	0		1933	Eddy (*195*).
Banana juice				0			1932	Wejdling (*725*).
Barley (*Hordeum vulgare*):								
Dried	Husked			0			1924	Harden and Zilva (*271*).
	do			0			1924	Honeywell and Steenbock (*336*).
	do	Trace					1933	Hughes (*344*).
	do		[110]				1931	Plimmer, Raymond, and Lowndes (*563*).
	do	[0]		[0]			1924	Southgate (*661*).
	do	[0]					1918	Steenbock, Kent, and Gross (*670*).
Germinated				[13]			1930	Matsuoka (*482*).
Barley germ			1,400 (Int.)				1935	Baker and Wright (*31*).
Bean (*Phaseolus* spp.):	Lima (*P. limenanus*) [*P. lunatus*], Henderson Bush, dwarf type.		100–150			100	1935	Funnell (*235*).
	Runner [*P. coccineus*]	500 (Int.)					1935	Coward and Morgan (*133*).
	Soybean. See Soybean.							
	Snap, green [*P. vulgaris*]			[25–33]			1933	Bessey and King (*47*).
	do	415					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591.*)
	do	1,000					(8)	Puerto Rico School of Tropical Medicine (Cook).
	do			20			1931	Von Hahn (*264*).
	do		40			25–28	(8)	Hawaii Agricultural Experiment Station (Miller).
	do	>860	15*	21–26			1927	Quinn, Burtis, and Milner (*579*).
	do			15			(8)	Columbia University (Eddy and Halliday). (See Rice and Munsell, 1931.) (*591.*)
	do		[18]*				1928	Rogers (*599*).
	Wax			15			1931	Von Hahn (*264*).
Frozen	Lima (*P. limenanus*) [*P. lunatus*], Henderson Bush, dwarf type.		Trace				1935	Funnell (*235*).
Dried	Butter [*P. lunatus*]		160 (Int.)				1935	Baker and Wright (*31*).
	Haricot [*P. vulgaris*]		120 (Int.) [6]					
	Lima [*P. lunatus*]	0					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591.*)
	Lima (*P. limenanus*) [*P. lunatus*], Henderson Bush, dwarf type.					Same as fresh	1935	Funnell (*235*).
	Mottled gram or urd (*P. mungo*)	233		0–trace			1934	Lo (*450*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Bean—Continued.								
Dried	Mung		170			170	1934	Reder (*588*).
	Mung [urd?] (*P. mungo*), green		100 (Int.)			[108]	1934	Ghosh and Guha (*238*).
	Mung (*P. radiatus*) [*P. aureus*], yellow.		15 (Int.)			0		
	Pinto [*P. vulgaris*]		1,050				1935	Greenwood (*249*).
	Red Kidney [*P. vulgaris*]		250			Trace	1930	Axtmayer (*22*).
	do	[0]					(8)	Puerto Rico School of Tropical Medicine (Cook).
Dried and stored	Over 1 year lima (*P. limenanus*) [*P. lunatus*], Henderson Bush, dwarf type.					Same as fresh	1935	Funnell (*235*).
Bean juice	Mung, China, and Bengal varieties.			0–trace			1934	Wats and Woodhouse (*718*).
Bean sprout	Mung [*P. aureus*]			25			1935	Ghosh and Guha (*239*).
	do	25	[20]*	40			1928	Miller and Hair (*499*).
	Mung from China, upper India, and Bengal.			[33]			1934	Wats and Woodhouse (*718*).
	Mung [urd?] (*P. mungo*), green		10 (Int.)			[48]	1934	Ghosh and Guha (*238*).
	Germinated 14 days, lima (*P. limenanus*) [*P. lunatus*], Henderson Bush, dwarf type.					1½ ungerminated	1935	Funnell (*235*).
Beef fat or suet		500					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*.)
Beef muscle			5				1934	Pierson (*561*).
						100	1931	Day (*158*).
						100	(8)	Columbia University (Booher and Harris).
						110	(8)	Columbia University (Stiebeling).
						124	(8)	Columbia University (Douglass).
			[150]				1933	Kemmerer and Steenbock (*387*).
			>33			>100	(8)	North Dakota Agricultural Experiment Station (Latzke).
		[15]					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*.)
			[42–62]			[102–150]	1931	Roscoe (*603*).
	Lean		50 (Int.) [6]				1935	Baker and Wright (*31*).

Dried	Dried at 37° C.					[429]	1933	Roscoe (*604*).
	Dried at 10° C., sealed under vacuum.		150–200			400–500	(8)	North Dakota Agricultural Experiment Station (Latzke).
Beet (*Beta vulgaris*)	[Garden]			8 or slightly more			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	do					50	1931	Day (*159*).
	do			<20			1931	Von Hahn (*264*).
	do	0					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*.)
	do			11			(8)	Columbia University (Quinn and Hartley). (See Rice and Munsell, 1931.) (*591*.)
	Sugar			5			1927	Scheunert (*631*).
	Mangels, sugar			3–5			1922	Wisconsin Agricultural Experiment Station (*751*).
	Mangolds [stock]	0					1922	Boock and Trevan (*67*).
Beet greens	[Garden]					250	1931	Day (*159*).
Blackberry (*Rubus* spp.):								
Frozen				6			1934	Batchelder (*41*).
		200–400					1934	Batchelder (*40*).
Frozen and stored	Stored at 15° F.	250		6			1935	Batchelder, Miller, Sevals, and Starling (*42*).
Black-eyed pea	See Cowpea.							
Blood, cow's	Cows receiving additional vitamin D:							
	Irradiated yeast, 100,000 units daily.				400		1932	Hess, Light, Frey, and Gross (*307*).
	Irradiated yeast, 450,000 units daily.				670			
	Irradiated ergosterol, 1,500,000 units daily.				670			
Blueberry (*Vaccinium* spp.):				25			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
				<10			1931	Von Hahn (*263*).
				5–7			1929	Scheunert (*632*).
	V. corymbosum (highbush), Maine			20–25				
Frozen and stored	Quick-frozen at −30° F., stored at 0° F. 5 to 8 months, *V. corymbosum* (highbush), Maine.			Same as fresh			1933	Fellers and Isham (*221*).
	Quick-frozen, stored at 0° F., *V. pennsylvanicum* (lowbush), Maine.	<30		6–7				

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Brain	Hog			[30]			1933	Bessey and King (*47*).
	Pig		60 (Int.)				1935	Baker and Wright (*31*).
	Lamb		100				1934	Pierson (*561*).
	Sheep		8					
Bran	See Wheat bran.							
Broccoli (*Brassica oleracea botrytis*).	[Italian variety], flower, leaf, and stem.					140	(8)	Columbia University (Douglass).
	do			18			(8)	Columbia University (Quinn). (See Rice and Munsell, 1931.) (*591*.)
	[Italian variety], flower and stem		33			32–37	1932	Munsell and Kifer (*537*).
Broccoli flowers	[Italian variety]					80	(8)	Columbia University (Douglass).
	do	6,900					(8)	Columbia University (Rice and Bessey).
	Italian variety, grown in Arizona, purchased on open market.		66			400	1935	Roehm (*598*).
Broccoli leaves	[Italian variety]					154	(8)	Columbia University (Douglass).
	do	30,400					(8)	Columbia University (Rice and Bessey).
	Italian variety, grown in Arizona, purchased on open market.		50			300	1935	Roehm (*598*).
Broccoli stems	[Italian variety]					77	(8)	Columbia University (Douglass).
	do	1,300					(8)	Columbia University (Rice and Bessey).
Brussels sprouts (*Brassica oleracea gemmifera*).			60 (Int.)				1935	Baker and Wright (*31*).
				100			1931	Von Hahn (264).
		288					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*.)
				50			1929	Scheunert (*632*)

Buckwheat (*Fagopyrum esculentum*).			[220]				1931	Plimmer, Raymond, and Lowndes (*563*).
			[55–66]				1927	Plimmer, Rosedale, Raymond, and Lowndes (*566*).
Butter, cow's					75–100 (Int.)		1928	Coward (*124*).
		[1,540]					1925	Holmes (*330*).
		4,000					(5)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*.)
	17 samples				40 (Int.)–400 (Int.) 120 (Int.) average.		1935	Coward and Morgan (*133*).
	Dairy	4,500 (Int.)						
	do	3,360 (Int.)						
	February, uncolored	Approximately ½ June butter.					1935	Sutton and Stoltz (*677*).
	February, colored with carotene to shade of June butter.	Approximately ¾ June butter.						
	Pasteurized	[3,770]					1933	Poe and Fehlmann (*567*).
	Unpasteurized	[3,610]						
	Made from sour or sweet cream with approximately same composition.	4,100					1935	Hathaway and Davis (*286*).
	Made from sweet cream	4,800						
	do	4,900						
	Cows on pasture:							
	Spring	3,600					1933	Hilton, Hauge, and Wilbur (*326*).
	do				150 (Int.)		1933	Watson, Drummond, Heilbron, and Morton (*720*).
	Spring, May 20–June 1	2,268 (Int.)						
	Spring, Apr. 15–May 10, winter diet of roots, hay, concentrates.	1,650 (Int.)					1933	Gillam, Heilbron, Morton, Bishop, and Drummond (*242*).
	Spring, Apr. 15–May 23, winter diet of roots, hay, concentrates.	1,850 (Int.)						
	Spring, Apr. 15–May 10, winter diet same as above with 70 percent of concentrates replaced by artificially dried N-treated grass.	1,900 (Int.)						
	Spring, Apr. 15–May 23, winter diet same as immediately above.	2,080 (Int.)						
	Summer	1,800 (Int.)					1934	Gillam (*240*).
	do	1,762 (Int.)					1934	Gillam and Heilbron (*241*).
	do	[2,000]					1931	Morgan and Coward (*525*).
	do	3,330					1933	Wilbur, Hilton, and Hauge (*729*).
	Autumn	3,200					1933	Hilton, Hauge, and Wilbur (*326*).
	do				<100 (Int.)		1933	Watson, Drummond, Heilbron, and Morton (*720*).
	Autumn, Nov. 26	1,670 (Int.)						
	do	1,720 (Int.)						

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Butter, cow's—Con.	Cows stall-fed:							
		Same as summer			<Summer		1932	Crawford, Perry, and Zilva (*141*).
		970 (Int.)					1934	Gillam (*240*).
					40 (Int.)		1933	Kon and Booth (*408*).
	Ordinary winter ration	615					1934	Gillam and Heilbron (*241*).
	Rich winter diet	1,263						
	Alfalfa hay	3,200					1933	Hilton, Hauge, and Wilbur (*326*).
	Soybean hay	2,500						
	Timothy hay	1,200						
	Grass silage				<100 (Int.)			
	Grass, artificially dried, non-N-treated.				<100 (Int.)		1933	Watson, Drummond, Heilbron, and Morton (*720*).
	Grass, artificially dried, N-treated.				<100 (Int.)			
	Roots, hay, concentrates, Dec. 10–Mar. 16.	717 (Int.)						
	Above ration with most of hay replaced by grass silage, Dec. 10–Mar. 16.	816 (Int.)						
	Roots, hay, concentrates diet with 70 percent concentrates replaced by artificially dried N-treated grass, Dec. 10–Mar. 16.	1,670 (Int.)					1933	Gillam, Heilbron, Morton, Bishop, and Drummond (*242*).
	Same as immediately above except that non-N-treated grass fed Dec. 10–Mar. 16.	1,378 (Int.)						
	Alfalfa hay, grain, silage plus linseed meal.	2,800						
	Alfalfa hay, grain, silage plus raw soybean.	1,750						
	Alfalfa hay, grain, silage plus roasted soybean.	1,870					1935	Wilbur, Hilton, and Hauge (*730*).
	Soybean hay, grain, silage plus linseed meal.	2,300						
	Soybean hay, grain, silage plus raw soybean.	1,500						
	Soybean hay, grain, silage plus roasted soybean.	1,700						
Stored	5–10 months	Same as fresh			Same as fresh			
	1–3 years, Australian and New Zealand.	do			do		1932	Crawford, Perry, and Zilva (*141*).
	2 years, English	<Fresh						

Butter, goat's	Summer	3,000					(8)	United States Department of Agriculture, Bureau of Animal Industry (Ellis).
	Winter	2,500						
	June-December	702 (Int.)					1934	Gillam and Heilbron (*241*).
Butterfat, cow's					170		1932	Krauss, Bethke, and Monroe (*416*).
					83–167		1933	Krauss, Bethke, and Wilder (*417*).
		Varies with breed of cow.					1935	Sutton and Krauss (*676*).
	Guernsey cow				125		1932	Hess, Light, Frey, and Gross (*307*).
	Cows on pasture:							
	Spring, May 12–June 5	8,500 (Int.)					1934	Booth, Kon, and Gillam (*70*).
	Summer	3 × winter					1933	Booth, Kon, Dann, and Moore (*69*).
	——do	1,700–5,000					1933	Fraps and Treichler (*234*).
	——do	[1,930]					1925	Holmes (*330*
	Autumn, Sept. 18–Oct. 23, plus silage and kale.	6,500 (Int.)					1934	Booth, Kon, and Gillam (*70*).
	Oct. 18–Nov. 2 on pasture after 6 months stall feeding, cow 1.	3,200					1934	Fraps,, Copeland, and Treichler (*230*).
	Oct. 18–Nov. 2 on pasture after 6 months stall feeding, cow 2.	2,500						
	Cows stall-fed:							
	Winter ration, Feb. 12–Mar. 1	4,000 (Int.)						
	Dry feed				130–170		1934	Booth, Kon, and Gillam (*70*).
							1934	Krauss, Bethke, and Wilder (*418*).
	Cottonseed meal and hulls	200						
	Silage	400					1932	Fraps and Treichler (*231*).
	From 2 Shorthorn cows, pre-experimental period.				17 (Int.)			
	From above 2 Shorthorn cows, fed 2 pounds cacao shell daily (32,000 Int. units vitamin D).				51 (Int.)		1935	Kon and Henry (*409*).
	From 2 Shorthorn cows, pre-experimental period, controls.				20 (Int.)			
	From 2 Shorthorn cows, experimental period, controls.				21 (Int.)			
	Cows receiving controlled amounts of vitamin A:							
	Little or no vitamin A—							
	Apr. 11–12, 1932	4,000					1934	Fraps, Copeland, and Treichler (*230*).
	Apr. 18–19, 1932	2,500						
	Apr. 25–26, 1932	3,800						
	May 2–3, 1932	2,000						
	May 16–17, 1932	800						
	May 30–31, 1932	800						
	June 27–28, 1932	1,100						
	July 25–26, 1932	700						
	Aug. 22–23, 1932	300						

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Butterfat, cow's—Continued.	Cows receiving controlled amounts of vitamin A—Continued.							
	Little or no vitamin A—Contd.							
	Sept. 19–20, 1932	200						
	Oct. 17–18, 1932	100						
	Oct. 18–Nov. 2 on pasture	3,200						
	6 to 7 pounds yellow corn, approximately 17,000 units of vitamin A daily—							
	Apr. 11–12, 1932	3,800						
	Apr. 18–19, 1932	1,700						
	Apr. 25–26, 1932	3,800						
	May 2–3, 1932	1,500						
	May 16–17, 1932	1,200						
	May 30–31, 1932	700						
	June 27–28, 1932	600						
	July 25–26, 1932	500						
	Aug. 22–23, 1932	200						
	Sept. 19–20, 1932	400						
	Oct. 17–18, 1932	500						
	Oct. 18–Nov. 2 on pasture	2,500						
	Yellow corn as only source of vitamin A, approximately 8,500 units daily—							
	Apr. 22, 1933	2,500					1934	Fraps, Copeland, and Treichler (*230*).
	May 20, 1933	800						
	June 17, 1933	800						
	Aug. 12, 1933	400						
	Sept. 9, 1933	300						
	Yellow corn plus 3 pounds heat-dried alfalfa meal, approximately 6,000 units vitamin A daily—							
	Apr. 22, 1933	7,000						
	May 20, 1933	1,400						
	June 17, 1933	1,400						
	Aug. 12, 1933	1,000						
	Sept. 9, 1933	700						
	Nov. 4, 1933	1,000						
	Yellow corn plus 6 pounds heat-dried alfalfa meal, approximately 116,000 units vitamin A daily—							
	Apr. 22, 1933	3,300						
	May 20, 1933	2,000						

	June 17, 1933	1,200					1934	Fraps, Copeland, and Treichler (*230*)
	Aug. 12, 1933	1,100						
	Sept. 9, 1933	1,000						
	Nov. 4, 1933	1,000						
	Cows receiving additional vitamin D:							
	Cod-liver oil concentrate				156–833		1932	Krauss, Bethke, and Monroe (*416*).
	Irradiated ergosterol:							
	60,000 units daily				290–2,500		1934	Krauss, Bethke, and Wilder (*418*).
	120,000 units daily				2,080			
	1,500,000 units daily, Guernsey cow.				2,000		1932	Hess, Light, Frey, and Gross (*307*).
	Irradiated yeast:				50,000			
	60,000 units daily				3,130		1934	Krauss, Bethke, and Wilder (*418*).
	120,000 units daily				3,330			
	100,000 units daily, Guernsey cow.				3,600–4,500		1932	Hess, Light, Frey, and Gross (*307*).
	450,000 units daily, Guernsey cow.				25,000			
	Irradiated yeast or ergosterol				2–16 × ordinary		1931	Thomas and MacLeod (*691*).
	Cows irradiated				Same as nonirradiated.		1930	Steenbock, Hart, Riising, Hoppert, Basherov, and Humphrey (*669*).
Cabbage (*Brassica* spp.).				33			1934	Povolotzkaya, Bukin, Harder, and Makarova (*577*).
		880 (Int.)					1935	Coward and Morgan (*133*).
	Common, head			25–100			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	Green and white, immature	50					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
	do	70–85					(8)	Columbia University (Gates).
	Green			[67]			1918	Chick and Rhodes (*103*).
	do			[100]			1918	Delf (*161*).
	do			[150]			1931	Von Hahn (*264*).
	do		[40–67]			[50]	1930	Roscoe (*601*).
	White, mature			40–67			1929	Clow, Marlatt, Peterson, and Martin (*113*).
	do	0					1930	Clow, Parsons, and Stevenson (*114*).
	do	13–23					(8)	Columbia University (Gates).
	do			86			1924	Eddy and Kohman (*198*).
	do			80			1931	Von Hahn (*264*).
	do			71			(8)	Columbia University (La Mer). (See Rice and Munsell, 1931.) (*591*).
	do	15					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Cabbage—Contd.	White, mature		[55]				1933	Plimmer, Raymond, and Lowndes (*565*).
	do		[40-67]			[30-60]	1930	Roscoe (*601*).
	do	0		100			1929	Scheunert (*632*).
	Red			100			1931	Von Hahn (*264*).
	do			100			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	Chinese (*B. chinensis*)	2,000	22	30-50			1932	Miller (*497*).
	do	5,000	Slightly >22				1933	Miller and Robbins (*500*).
	do					25	(5)	Hawaii Agr. Expt. Sta. (Miller).
	Savoy			50-100			1929	Scheunert (*632*).
	do			100			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	Savoy, green		80 (Int.)				1935	Baker and Wright (*31*).
	Savoy, white		60 (Int.)					
Cabbage juice				[100]			1920	Delf (*162*).
Cabbage, fermented (sauerkraut).				Slightly <3			1930	Lawrow and Jarussowa (*440*).
		15					(6)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	Fresh prepared (laboratory)			20-30			1929	Clow, Marlatt, Peterson, and Martin (*113*).
	New			<20			1931	Von Hahn (*264*).
	Old			<10				
	Commercial			0-30			1933	Parsons and Horn (*555*).
	Commercially canned, 6 brands	0		13-40			1930	Clow, Parsons, and Stevenson (*114*).
	Commercially canned under known conditions, 4 brands.			13-20			1933	Parsons and Horn (*555*).
	Fermented in ordinary brine			50 percent fresh cabbage.			1934	Povolotzkaya, Bukin, Harder, and Makarova (*577*).
	Fermented with pure cultures lactic acid bacteria.			80-90 percent fresh cabbage.				
	Kept 24 hours in laboratory, layer 2 cm thick.			33 percent fresh sauerkraut.			1934	Povolotzkaya, Bukin, Harder, and Makarova (*577*).
Cabbage, fermented, juice.				3			1930	Lawrow and Jarussowa (*440*).
	Fresh prepared (laboratory)			20-30			1929	Clow, Marlatt, Peterson, and Martin (*113*).
Cacao (*Theobroma cacao*).								
	Cocoa powder		0 (Int.)		100 (Int.)		1932	Coward (*126*).
							1935	Baker and Wright (*31*).

Cacao shell	Byproduct of chocolate manufacturing.				3,500 (Int.)		1935	Kon and Henry (*409*).
	Sun-dried, commercial				2,800 (Int.)		1934	Knapp and Coward (*399*).
Cacao shell fat					30,000 (Int.)		1935	Kon and Henry (*409*)
Cantaloup	See Muskmelon.							
Carrot (*Daucus carota*):				<6–6			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
			60 (Int.)				1935	Baker and Wright (*31*).
		1,770 (Int.)					1935	Coward and Morgan (*133*).
		1,980 (Int.)						
	Red, Valeria (St. Valery) and Chantenay.	2,500					1934	Ivanov and Smirnova (*351*).
	White	0						
	Yellow, Asiatic variety	620						
	Yellow [orange], young					50	1931	Day (*159*).
	do	2,000–3,333					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*691*.)
	do		Same as mature stored.			Same as mature stored.	1931	Roscoe (*602*).
	do			5–7			1931	Spohn and Hunter (*663*).
	Yellow [orange], young			[10]			1931	Wasson (*716*).
	Yellow [orange], mature					43–50	(8)	Columbia University (Bisbey).
	do					30	(8)	Columbia University (Booher and Williams).
	do	4,300–6,700					1933	Fraps and Treichler (*234*).
	do		[19]*				1930	House, Nelson, and Haber (*341*).
	do			6			1931	Kohman, Eddy, and Gurin (*404*).
	do		[40]	[5]			1933	Langley, Richardson, and Andes (*438*).
	do		[50–100]			[<60]	1931	Roscoe (*602*).
	do			[10]			1922	Wisconsin Agricultural Experiment Station (*751*).
	Yellow [orange], mature, shredded, after standing 1 hour.			5			1931	Kohman, Eddy, and Gurin (*404*).
	Yellow [orange], mature, shredded, after standing 3 hours.			3				
	Yellow [orange], mature	1,600–1,700					(8)	Columbia University (Hessler).
Stored	do		Same as fresh*				1930	House, Nelson, and Haber (*341*).
	do		do			Same as fresh	1931	Roscoe (*602*).
	do			[6–10]			1931	Wasson (*716*).
	Yellow [orange], mature, cool, damp cellar.	Same as fresh	Same as fresh	[6–10]			1933	Langley, Richardson, and Andes (*438*).
	Yellow [orange], mature, warm dry cellar.	do	do	[6]				

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Carrot—Continued.								
Dried	Yellow [orange], mature, in air	2,500					1933	Fraps and Treichler (*234*).
	Yellow [orange], mature, in vacuum.	7,700						
Carrot juice				[10]			1919	Chick and Delf (*101*).
Carrot tops						200	1931	Day (*159*).
Dried		1,600					1933	Fraps and Treichler (*234*).
Cauliflower (*Brassica oleracea botrytis*).			110 (Int.)				1935	Baker and Wright (*31*).
						60	(5)	Douglass.
		50					(5)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
	Buds			100			1931	Von Hahn (*264*).
Celery stalks (*Apium graveolens*).			Trace (Int.)				1935	Baker and Wright (*31*).
	Green	[1,300]	Slightly>hearts	[9]			1931	Kohman, Eddy, and Gurin (*404*).
	Bleached	0					(5)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
	do			11			(5)	Columbia University (Sherman).
	do			17–33			1930	Matsuoka (*480*).
	Bleached, with ethylene		Same as board bleached.				1928	Babb (*28*).
	Bleached hearts	[23]	[<20]*	[9]			1931	Kohman, Eddy, and Gurin (*404*).
Celery leaves	Green	650					(5)	Columbia University (Munsell).
Chard (*Beta vulgaris*)		17,200					(5)	Columbia University (Rice and Bessey).
Chayote (*Chayota edulis*).		[0]					1933	Axtmayer and Cook (*24*).
Cheese	Cheddar		0 (Int.)				1935	Baker and Wright (*31*).
	Cheddar, American	2,000					1933	Cook and Axtmayer (*118*).
	do	2,860					(5)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	do					170	(5)	Day.
	Cheddar, English					[144–288]	1929	Aykroyd and Roscoe (*27*).

	do	5,500 (Int.)					1935	Coward and Morgan (*135*).
	Cheshire		30 (Int.)[6]				1935	Baker and Wright (*31*).
	Cottage, skim milk	80					(5)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
	Cream					44	(5)	Day.
	do	3,450			do		(5)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	Cream, crustless		0 (Int.)				1935	Baker and Wright (*31*).
	Gorgonzola		30 (Int.)					
	Parmesan, Italian	1,266					(5)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
Cherry (*Prunus* spp.):	Black Heart			<50			1931	Von Hahn (*263*).
	Early red; black, sweet; and white, sour.			10–20			1929	Scheunert (*632*).
Frozen	Bing	220					1933	Potter and Dickson (*572*).
	Deacon	140						
	Early Richmond	500					1934	Kramer and Agan (*411*).
	Lambert	Trace					1933	Potter and Dickson (*572*).
	Late Duke	710						
	Montmorency	500					1934	Kramer and Agan (*411*).
	do	1,190					1933	Potter and Dickson (*572*).
	Royal Ann [Napoleon]	380						
Chestnut (*Castanea* spp.)			90 (Int.)				1935	Baker and Wright (*31*).
			[110]				1929	Plimmer, Raymond, and Lowndes (*562*).
Chicken	Dark meat		[600]				1933	Kemmerer and Steenbock (*387*).
	Light meat		[300]					
Chicken fat					[435]		1927	Hess and Weinstock (*314*).
Chicken liver				[30]			1925	Hart, Steenbock, Lepkovsky, and Halpin (*288*).
					[200]		1927	Hess and Weinstock (*314*).
			[800]				1933	Kemmerer and Steenbock (*387*).
					Much>beef		1925	Wisconsin Agricultural Experiment Station (*752*).
Chickpea (*Cicer arietinum*):			15 (Int.)			[198]	1934	Ghosh and Guha (*238*).
Dried			500*				1928	Mitchell (*505*).
	Garbanzo of Mexico	50					1933	Axtmayer and Cook (*24*).
Chive (*Allium schoenoprasum*).				100			1931	Von Hahn (*264*).
Cider	See Apple juice.							

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Citron (*Citrus medica*).	Mesocarp, Puerto Rico	60–70		50			(8)	Massachusetts State College (Fellers).
Clam	Hard shell (*Venus mercenaria*), quahaugs.	Slightly<20			Slightly>oysters		1928	Jones, Nelson, and Murphy (*369*).
	Soft shell (*Mya arenaria*)	[20]			do		1928	Jones, Nelson, and Murphy (*369*).
Coconut (*Cocos nucifera*):	Ripe	0					(8)	Puerto Rico School of Tropical Medicine (Cook).
	do	0	44–50*				1929	Miller (*496*).
Dried			Trace (Int.)				1935	Baker and Wright (*31*).
Coconut milk	Expressed from firm white pulp	0	9*	0			1929	Miller (*496*).
Coconut oil					[0]		1927	Bills (*54*).
Coconut water				5			1936	Miller, Bazore, and Robbins (*498*).
	From immature coconuts			4			1929	Miller (*496*).
	From mature coconuts	0	0	0			1929	Miller (*496*).
Codfish			40 (Int.)				1935	Baker and Wright (*31*).
		Trace					(8)	Columbia University (Rice).
Cod-liver oil	Crude	[522,700]					1931	Coward, Dyer, Morton, and Gaddum (*130*).
	Refined:				28,000		1933	Bethke, Record, and Kennard (*50*).
					10,000 (Int.)		1934	Bills, Massengale, and Imboden (*58*).
		65,000–205,000					1931	Coward, Dyer, Morton, and Gaddum (*130*).
		19,500–20,000					1934	Datta and Banerjee (*155*).
					[15,000]		1930	Holmes and Pigott (*324*).
		Sl.>66,700–70,000			>20,000–<33,000		1932	Jones and Christiansen (*370*).
		156,600			134,000		1935	Jones and Christiansen (*371*).
					[18,750] (Int.)		1933	Kon and Booth (*498*).
		[76,900]					1931	Morgan and Coward (*525*).
					14		1928	Munsell and Black (*533*).
		200,000					1934	Sherman and Todhunter (*647*).
		[84,800]					1931	Truesdail and Boynton (*701*).
					20,800		1933	Truesdail and Culbertson (*702*).
		25,000–125,000					1932	Wise and Heyl (*754*).
		33,300					1926	Wyman, Holmes, Smith, Stockbarger, and Pigott (*761*).
		120,000					1927	Wyman, Holmes, Smith, Stockbarger, and Pigott (*762*).

	24 samples	60,000 (Int.)–400,000 (Int.); 200,000 (Int.) average.					1935	Coward and Morgan (*133*).
	240 samples				6,000 (Int.)–30,000 (Int.); 15,000 (Int.) average.			
	From individual livers				Variations of 1,000 times.		1929	Hess, Bills, and Honeywell (*302*)
	Iceland	100,000–200,000			20,000 (Int.)–50,000 (Int.).		1930	Drummond and Hilditch (*180*).
	Newfoundland	33,000–200,000			14,000 (Int.)–50,000 (Int.).			
	----do				[10,000–12,500]		1931	Poulsson (*574*).
	----do	5/4 Norwegian			½–⅝ Norwegian		1933	Poulsson (*575*).
	Norway	10,000–14,000			10,000 (Int.)–20,000 (Int.).		1930	Drummond and Hilditch (*180*).
	----do	80,000–120,000			[13,500–33,900]		1932	Ewe (*214*).
	----do				[20,000–25,000]		1931	Poulsson (*574*).
	----do	80 percent Newfoundland.			160–200 percent Newfoundland.		1933	Poulsson (*575*).
	Norway, commercial, purchased in Japan.				10,000		1934	Kawai and Yoshida (*383*)
	Scotland	10,000–50,000			8,000 (Int.)–20,000 (Int.).		1930	Drummond and Hilditch (*180*).
	From young fish	<From old					1933	MacPherson (*470*).
	From spawning fish	<Nonspawning			>Nonspawning		1934	Poulsson and Ender (*576*).
	Codling (*Gadus callarias*), smaller specimens.	0.1 mature cod					1933	Lovern, Edisbury, and Morton (*454*).
	Codling (*G. callarias*), larger specimens.	0.2 mature cod						
	From rotted livers	>40,000–<50,000			16,700		1932	Jones and Christiansen (*370*).
Stored	Basement, 50–60° F., 26 months, unwrapped bottles.	[133,300]						
	Basement, 50–60° F., 26 months, wrapped bottles.	[250,000]						
	Glass-doored cabinet, 14 months, unwrapped bottles.	[111,000]						
	Glass-doored cabinet, 14 months, wrapped bottles.	[154,000]						
	Laboratory table, 21 months, unwrapped bottles.	[55,000]					1926	Holmes and Pigott (*333*).
	Laboratory table, 21 months, wrapped bottles.	[94,300]						
	Window sill, direct sunlight, 24 months, unwrapped bottles.	0						
	Window sill, direct sunlight, 24 months, wrapped bottles.	Small amount						
	Direct sunlight, 16 months, unwrapped bottles.	0						

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Cod-liver oil—Con.								
Stored	Direct sunlight, 16 months, wrapped bottles.	[74,000]					1926	Homes and Pigott (*333*).
	16 months, in bottles, tin cans, or barrels.				Same as fresh		1933	Sheehy (*642*).
	4 years, away from sunlight	Same as fresh					1933	Ewe (*215*).
Coffee bean (*Coffea* spp.).	Green		[< 140]				1929	Plimmer, Raymond, and Lowndes (*562*).
	Ground		140 (Int.)[6]				1935	Baker and Wright (*51*).
	Roasted		[0]				1929	Plimmer, Raymond, and Lowndes (*562*).
Collard (*Brassica oleracea acephala*).		2,100–4,300	[51]*	[90]			1928	Burton (*90*).
		5,700	100	200		100	1931	Newton (*548*).
Colostrum, cow's		10–100 × milk					1933	Dann (*154*).
		Much>milk					1934	Kansas Agricultural Experiment Station (Kramer) (*252*).
	From 5 different breeds	5–15 × milk					1934	Semb, Baumann, and Steenbock (*640*).
Colostrum, human		Much>milk					1934	Van Eekelen and de Haas (*201*).
Corn (*Zea mays*):								
Immature	Field				>Mature		1933	Templin and Steenbock (*690*).
	Sweet			[17]			1926	Eddy (*195*).
Cured	Red, Bloody Butcher, red pericarp	180–550					1931	Fraps (*229*).
	do	250–500					1933	Fraps and Treichler (*234*).
	Red, Fentress Strawberry, variegated pericarp.	90–290					1931	Fraps (*229*).
	do	110–500					1933	Fraps and Treichler (*234*).
	White	0					1933	Hughes (*344*).
	do		143				1931	Munsell (*531*).
	White, 27 varieties	0–<25					1931	Fraps (*229*).
	Yellow	[430]					1933	Hughes (*344*).
	do		[110–125]				1931	Hetler, Meyer, and Hussemann (*323*).
	do	[133]					1929	Meyer and Hetler (*488*).
	do	200					1930	Russell (*611*).
	do	370					1930	Smith (*658*).
	Yellow, 20 samples grown in 11 different localities.	250–800					1931	Fraps (*229*).
	Yellow, Ferguson Yellow Dent	500–660					1933	Fraps and Treichler (*234*).
	do	700					1933	Fraps and Treichler (*232*).
	Red pericarp, yellow endosperm	250					1933	Fraps and Treichler (*234*).
	White capped, yellow dent	133					1930	Russell (*611*).

Cured and stored	Red, 15 months, Fentress Strawberry.	70–83 percent fresh					1933	Fraps and Treichler (*234*).
	Red, 18 months, Bloody Butcher	25 percent fresh						
	Yellow, 7 months	70 percent fresh						
	Yellow, 30 months	15 percent fresh						
	Yellow, 5 months, Ferguson Yellow Dent.	40 percent fresh					1933	Fraps and Treichler (*232*).
	do	35 percent fresh					1933	Fraps and Treichler (*234*).
	Yellow, December 1932	650					1934	Sherwood and Fraps (*650*).
	Yellow, March and April 1933	500						
	Yellow, June 1933	500						
	Yellow, July 1933	400						
	Yellow, June 1933	250					1934	Fraps, Copeland, and Treichler (*230*).
	Yellow, October 1933	300						
	Yellow, ground, May and June 1932.	600						
Cured, ground, and stored.	Yellow, 5 months	50 percent fresh					1933	Fraps and Treichler (*234*).
	Yellow, 6 months	20–40 percent fresh					1933	Fraps and Treichler (*232*).
	do	50 percent fresh					1933	Fraps and Treichler (*234*).
	Yellow, 7 months	60 percent fresh					1933	Fraps and Treichler (*232*).
	Yellow, 30 months	15 percent fresh						
	do	do					1933	Fraps and Treichler (*234*).
Corn meal	White	0					1933	Do.
	White, bolted or unbolted	[0]					1931	Fraps (*229*).
	Yellow	300						
	do	300–500					1933	Fraps and Treichler (*234*).
Stored	Yellow, 8 months	65 percent fresh					1933	Do.
Corn bran			[6]*				1925	Croll and Mendel (*144*).
		0					1929	Meyer and Hetler (*488*).
Corn endosperm						[0–trace]	1930	Aykroyd (*26*).
			[0]*				1925	Croll and Mendel (*144*).
Corn germ			[100–160]				1932	Illinois Agr. Expt. Sta. (Meyer and Roy). (*528*).
		Trace					1929	Meyer and Hetler (*488*).
	Maize		460 (Int.)[6]				1935	Baker and Wright (*31*).
Corn germ meal		0					1929	Meyer and Hetler (*488*).
			Trace				1927	Plimmer, Rosedale, Raymond, and Lowndes (*566*).
Corn gluten	Yellow	[1,000]					1929	Meyer and Hetler (*488*).
	do		Trace				1927	Plimmer, Rosedale, Raymond, and Lowndes (*566*).
Corn oil	Crude	[70]					1929	Meyer and Hetler (*488*)
	Refined				[0]		1927	Bills (*54*).
	do				[0]		1922	McCollum, Simmonds, Becker, and Shipley (*459*).
	do	0					1929	Meyer and Hetler (*488*)
Cornsalad (Lamb's lettuce) (*Valerianella olitoria*).				40			1931	Von Hahn (*264*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Cottonseed (*Gossypium* spp).		[0]					1922	Drummond and Zilva (*183*)
Cottonseed flour			470			170	1933	Munsell and DeVaney (*534*).
Cottonseed meal		[10]					1933	Fraps and Treichler (*234*).
Cottonseed oil			[800]			[250]	1933	Whitsitt (*727*).
		0			[0]		1927	Bills (*54*).
							1933	Fraps and Treichler (*234*).
					[0]		1922	McCollum, Simmonds, Becker, and Shipley (*459*).
			0			0	1933	Whitsitt (*727*).
Cowberry (*Vaccinium vitisidaea*).				<7			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
Cowpea (*Vigna sinensis*):								
Dried		200					1933	Fraps and Treichler (*234*).
		300					1933	Fraps and Treichler (*232*).
Dried and stored	Black-eyed peas					140	1934	Bankston and Giddings (*34*).
	7 months	66 percent fresh dried					1933	Fraps and Treichler (*234*).
	9 months	50 percent fresh dried						
	14 months	23 percent fresh dried						
Dried and germinated				[40]			1921	Delf (*163*).
Cranberry (*Vaccinium* spp.):	*V. oxycoccus*			12			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	[*V. macrocarpus*]			25–31			1933	Fellers (*216*).
	do	20	0	22–29	0	0	1933	Isham and Fellers (*350*).
				8–16			1934	Jarussowa (*356*).
	V. oxycoccus			12			1934	Murri and Kudrjavtzeva (*540*).
	Picked after snow melts			<Picked in snow				
Stored	0–8° C			<Fresh			1934	Murri, Onokhova, Kudrjavtzeva, and Gutzevich (*541*).
	15° F			Gradual loss				
	40° F			Twice loss at 15° F				
	3 months, 40° F			Slightly<fresh			1933	Isham and Fellers (*350*).
	4 to 6 months, 40° F			80 percent fresh				
	7 to 10 months			30–40 percent fresh				
	7 to 11 months, warehouse product [*V. macrocarpus*]			Much<20			1930	MacLeod and Booher (*469*).

Frozen				Same as fresh				
Frozen and stored	Whole, sliced or crushed, sweetened, 0° or −15° F.			do			1933	Isham and Fellers (*350*).
	9 months			do				
Dried		120	0		0	Trace	1933	Fellers (*216*).
	Whole, dehydrated, or evaporated, 8 to 12 hours, 120° to 150° F.	Slightly <200	0	0	0	0		
	Film, in air			30–35 percent fresh			1933	Isham and Fellers (*350*).
	Film, in atmosphere of nitrogen			65 percent fresh				
	In vacuum			≤Cranberry juice				
Cranberry juice				<Whole fruit			1934	Murri and Kudrjavtzeva (*540*).
	Cold expressed			Same as fresh berries			1933	Isham and Fellers (*350*).
	Hot expressed			0				
Cream					[13]		1927	Hess and Weinstock (*314*).
	1 sample				50 (Int.)		1935	Coward and Morgan (*133*).
	20 percent, from Holstein milk 3.4 percent fat; November.	[1,000]					1933	Hathaway and Davis (*285*).
	20 percent, from Holstein milk 3.5 percent fat; February.	[768]						
	20 percent, from Jersey milk 6.4 percent fat; November.	[667]						
	20 percent, from Jersey milk 6.4 percent fat; February.	[550]						
Cress (*Lepidium sativum*).	[Land or garden]		50 (Int.) [6]				1935	Baker and Wright (*31*).
Cucumber (*Cucumis sativus*).			30 (Int.) [6]				1935	Do.
		25					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
				12			1931	Von Hahn (*264*).
				8–16			1934	Jarussowa (*355*).
				>25			1929	Thurman and Vahlteich (*692*).
						[60]	1935	Lo (*452*).
Cucumber juice				10–20			1934	Jarussowa (*355*).
Currant (*Ribes* spp.)	Wild			Same as cultivated			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	Black			200			1931	Von Hahn (*263*).
	Black, 3 varieties			100			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	Black, ripe			400				
	Black, unripe			200–400				
	Red			33				
Dried				16			1931	Von Hahn (*263*).
	Black			<50				
	Black, dried rapidly 80° C.			33			1934	Shivrina and Onokhova. (*652*).
	Black, dried slowly 30° C.			40				

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Currant—Contd.								
Dried and stored	Black, stored 1 year			12			1934	Jarussowa (*356*).
Currant juice	Black			[33]			1932	Lawrow, Janowskaja, and Jarussowa (*439*).
	Black (*R. nigrum*)			10				
Stored	2 to 5 months, black (*R. nigrum*), SO_2 treated.			Same as fresh			1934	Murri and Kudrjavtzeva (*540*).
Frozen and stored	2 to 5 months, −10° C., black			do				
Pasteurized	75° C., 20 minutes (3 times)			75 percent fresh				
Dandelion greens (*Leontodon taraxacum*).				10			1935	Kleiner and Tauber (*398*).
		20,000					1934	Kramer and Oberhelman (*414*).
		27,100						
Dari			[110]				1931	Plimmer, Raymond, and Lowndes (*563*).
			[88]				1927	Plimmer, Rosedale, Raymond, and Lowndes (*566*).
Darso			160			0	1934	Reder (*588*).
Date (*Phoenix dactylifera*):	Commercial			[0]			1931	Von Hahn (*263*).
	do			[0]			1930	MacLeod and Booher (*469*).
	do	150					[8]	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
Fresh			30 (Int.) [6]				1935	Baker and Wright (*31*).
	Deglet Noor	148			0		1933	Morgan (*511*).
	Hallawis [Halawy], Asiatic	86–114			Trace			
	Hallawis [Halawy], California	86–114			do			
	Maktum [Maktoom]	100		0			1931	Smith and Meeker (*659*).
Frozen	Hayany	100	50				1928	Smith (*657*).
Sterilized	Deglet Noor	140			[0]		1933	Morgan (*511*).
	do	80	33	0	0	0	1931	Smith and Meeker (*659*).
	Hallawis [Halawy], Asiatic	86–114		0	Trace		1933	Morgan (*511*).
	Hallawis [Halawy], California	86–114			do			
	Maktum [Maktoom]	100	40	0	0	0	1931	Smith and Meeker (*659*).
	Thoory	133	33	0	0	0		
	Hallawis [Halawy], California, washed and dried.	69					1933	Morgan (*511*).

Dewberry (*Rubus* spp.).				0			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
Dock leaves		Slightly <20,000					1934	Kramer and Oberhelman (*414*).
Eel oil	See Fish-body oils.							
Eggplant (*Solanum melongena*).		33					1933	Axtmayer and Cook (*24*).
				7			(2)	Columbia University (Quinn). (See Rice and Munsell, 1931.) (*591*).
		65					(2)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
			20 (Int.)			[300]	1934	Ghosh and Guha (*238*).
Eggs, hen's, whole				[0]			1926	Dougherty (*173*).
				[0]			1925	Hauge and Carrick (*287*).
		3,300					1932	Hessler and Cover (*319*).
		[>1,000]					1925	Jones, Murphy, and Moeller (*366*).
		[400]					1924	Murphy and Jones (*539*).
						Variable	1935	Bethke and Record (*49*).
	Boiled	1,665					(2)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
	do					99	1932	Todhunter (*697*).
	Market				Variable		1933	Maughan and Maughan (*485*).
	From confined birds receiving cod-liver oil.		[80]			[100]	1933	Ellis, Miller, Titus, and Byerly (*205*).
Stored	6 months in water glass	50 percent fresh					1926	Manville (*474*).
	6 to 9 months in water glass				Same as fresh		1927	Wisconsin Agricultural Experiment Station (Woods and Clow). (*106*).
	1 year, 30° F	13–25 percent fresh					1926	Manville (*474*).
	Electric refrigerator, 40° F				Same as fresh		1929	Wisconsin Agricultural Experiment Station (Clow and Marlatt). (*107*).
	After dipping in fat, 205° F., 5 seconds.				do			
	After dipping in fat, 375° F., 5 seconds.				do			
Frozen and stored	9 years	Same as fresh					1925	Jones, Murphy, and Moeller (*366*).
	Probably of Chinese origin	>50 percent fresh					1926	Manville (*474*).
Dried						448	1935	Morgan and Hunt (*519*).
Egg white, hen's			0				1929	Chick and Roscoe (*105*).
				[0]			1926	Dougherty (*173*).
				[0]			1925	Hauge and Carrick (*287*).
					0		1923	Hess (*300*).
				0			1934	Ray (*584*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Egg white, hen's—Continued.						60–120	1931	Roscoe (*603*).
	Boiled		Trace [6]				1935	Baker and Wright (*31*).
	do	0					1924	Munsell (*529*)
Egg yolk, hen's		3,000 (Int.)			150 (Int.) 500 (Int.)		1935	Coward and Morgan (*133*).
				0			1926	Dougherty (*173*).
				0			1925	Hauge and Carrick (*287*).
					>2,000		1923	Hess (*300*).
					Variable		1933	Maughan and Maughan (*485*).
				[0]			1934	Ray (*584*).
			[120–250]			[150]	1931	Roscoe (*603*).
					2,000		1924	Hess and Weinstock (*312*).
	Boiled					[150–300]	1929	Aykroyd and Roscoe (*27*).
	do	5,000					1924	Munsell (*529*).
	do		[77]				1933	Plimmer, Raymond, and Lowndes (*565*).
	Summer				330		1932	Wisconsin Agricultural Experiment Station (Steenbock and Scott). (*109*).
	Winter				71			
	Beginning of laying season, boiled	3,000					1932	Sherwood and Fraps (*649*).
	End of laying season, boiled	600						
	End of laying season, hens fed vitamin-A-enriched diets.	<Beginning of laying season.					1934	Sherwood and Fraps (*650*).
	From low-producing pullets, fourth month of first year.	2,500						
	From high-producing pullets, fourth month of first year.	2,500					1934	Kansas Agricultural Experiment Station (Kramer) (*252*) and
	From low-producing hens, averaging 93 eggs pullet year.	3,300					1935	Koenig, Kramer, and Payne (*401*).
	From high-producing hens, averaging 236 eggs pullet year.	2,000						
	Pale colored, from hens on pigment-poor ration containing cod-liver oil.	2,500						
	Medium color, from hens fed 65 percent yellow corn.	900						
	Dark color, from hens fed 65 percent yellow corn plus 10 percent alfalfa leaf meal.	2,800					1934	Bisbey, Appleby, Weis, and Cover (*62*).
	Light color, from hens fed 35 percent yellow corn.	700						
	Light color, from hens fed 25 percent yellow corn plus 0.5 percent cod-liver oil.	2,800						

From birds on bluegrass range	[2,500 or more]					1927	Bethke, Kennard, and Sassaman (*48*).
From birds on limited range	2,000					1935	DeVaney, Titus, and Nestler (*170*).
From birds on limited range, February				140 (Int.)		1933	DeVaney, Munsell, and Titus (*168*).
From birds on limited range, April				270 (Int.)			
From birds on limited range, May				320 (Int.)			
From birds on limited range, June				390 (Int.)			
From birds receiving controlled amounts of vitamin A:							
Confined indoors:							
No vitamin A supplement	[525–1,135]					1927	Bethke, Kennard, and Sassaman (*48*).
Cod-liver oil	[2,500 or more]						
1 percent cod-liver oil	Slightly <4,000					1935	DeVaney, Titus, and Nestler (*170*).
2 percent cod-liver oil	4,000						
8 percent cod-liver oil	8,000						
From hens averaging 224 units vitamin A per day in feed:							
November	2,500						
December	2,200						
January	1,200						
February	1,700						
March	1,200						
April	1,100						
May	800						
June	700						
July [7]	650						
August	600						
From hens averaging 336 units vitamin A per day in feed:							
December	2,000					1934	Sherwood and Fraps (*650*).
January	1,600						
February	1,600						
March	1,300						
April	1,300						
May	1,500						
June	1,500						
July [7]	1,350						
August	1,200						
From hens averaging 444 units vitamin A per day in feed:							
December	2,300						
January	2,000						
February	2,200						
March	1,300						
April	1,400						
May	1,400						
June	1,700						
July [7]	1,600						
August	1,500						

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Egg yolk, hen's—Continued.	From birds receiving approximately:							
	23,240 units vitamin A per month, February.	3,375					1935	Russell and Taylor (*613*).
	23,025 units vitamin A per month, February.	3,123						
	40,600 units vitamin A per month, February.	3,375						
	47,200 units vitamin A per month, May.	3,750						
	58,300 units vitamin A per month, May.	5,000						
	47,750 units vitamin A per month, May.	4,250						
	From birds receiving controlled amounts of vitamin D:							
	Confined indoors:							
	No vitamin D supplement, August.				[211]		1934	Branion, Drake, and Tisdall (*78*).
	1 percent cod-liver oil, August				[1,667]			
	1 percent viosterol 1 D, August				[1,667]			
	1 percent viosterol 250 D				[45,470]			
	1 percent viosterol 25,000 D				[1,000,000]			
	1 percent (cod-liver oil plus viosterol) 10 D.				[3,890]			
	2 percent cod-liver oil, February.				81		1935	Russell and Taylor (*613*).
	2 percent cod-liver oil, June				<81			
	2 percent cod-liver oil				48 (Int.)		1933	DeVaney, Munsell, and Titus (*168*).
	4 percent cod-liver oil				99 (Int.)			
	8 percent cod-liver oil				135 (Int.)			
	2 percent viosterol 5 D				93 (Int.)			
	4 percent viosterol 5 D				125 (Int.)			
	8 percent viosterol 5 D				520 (Int.)			
	Confined outdoors:							
	January to July (average)				[250]		1934	Branion, Drake, and Tisdall (*79*).
	1 percent cod-liver oil				[1,605]			
	1 percent viosterol 250D				[58,420]			
	1 percent viosterol 25,000 D				[1,085,000]			
	Confined, mature birds, end of first laying season:							
	1/32 percent fortified cod-liver oil.				140		1935	Guerrant, Kohler, Hunter, and Murphy (*253*).

	1/16 percent fortified cod-liver oil.				140		1935	Guerrant, Kohler, Hunter, and Murphy (*253*).
	1/8 percent fortified cod-liver oil.				250			
	3/16 percent fortified cod-liver oil.				330			
	1/4 percent fortified cod-liver oil.				500			
	3/8 percent fortified cod-liver oil.				500			
	1/2 percent fortified cod-liver oil.				1,000			
	Range, mature birds, end of first laying season:							
	No fortified cod-liver oil				330			
	1/8 percent fortified cod-liver oil.				2,000			
	Confined pullets, beginning of first laying season:							
	1/16 percent fortified cod-liver oil.				120			
	1/8 percent fortified cod-liver oil.				200			
	3/16 percent fortified cod-liver oil.				250			
	1/4 percent fortified cod-liver oil.				250			
	5/16 percent fortified cod-liver oil.				330			
	3/8 percent fortified cod-liver oil.				330			
	1/2 percent fortified cod-liver oil.				500			
	Confined yearling hens:							
	1/4 percent 8 D cod-liver oil				1,000			
	2 percent 8 D cod-liver oil				4,000			
	2 percent 8 D viosterol				4,000			
	In open-front house, exposed to sunlight:							
	2 percent cod-liver oil, January				100		1935	Russell and Taylor (*613*).
	2 percent cod-liver oil, May				200			
	Receiving irradiated diet				2,000		1932	Wisconsin Agricultural Experiment Station (Steenbock and Scott). (*109*).
	Irradiated birds				10 × nonirradiated		1925	Hart, Steenbock, Lepkovsky, Kletzien, Halpin, and Johnson (*281*).
	do				1/30 cod-liver oil		1933	Maughan and Maughan (*485*).
	Irradiated birds, 20 minutes, 6 days per week, January to July (average).				[306]		1934	Branion, Drake, and Tisdall (*79*).
Stored	Eggs laid in spring, stored until winter, boiled.		140 (Int.)				1935	Baker and Wright (*31*).
	Eggs laid in spring, stored until winter.				>Fresh winter		1929	Kentucky Agricultural Experiment Station (*121*).
Egg yolk oil, hen's		1/25 to 1/30 cod-liver oil					1924	Murphy and Jones (*539*).
Elderberry (*Sambucus* spp.).				<10			1931	Von Hahn (*263*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Endive (*Cichorium endivia*).	[Common]			20			1931	Von Hahn (*264*).
	Escarole					94	(8)	Columbia University (Douglass).
	do			11			(8)	Columbia University (Quinn). (See Rice and Munsell, 1931.) (*591*).
	do	19,600					(8)	Columbia University (Rice and Bessey).
	do	20,000					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	Escarole, whole, outer green leaves	10,000					(8)	U. S. Department Agriculture, Bureau Home Economics (Munsell and DeVaney).
	Escarole, greenest portion of outer leaves.	15,000						
Fennel seed (*Foeniculum*).		[0]					1922	Drummond and Zilva (*182*).
Fig (*Ficus carica*)								
Fresh	Lob Ingir and Kadota			3–5			1932	Morgan, Field, and Nichols (*517*).
	Mission			0				
	Brown Turkey	80 (Int.)	10 (Int.)	5		33	1936	Miller, Bazore, and Robbins (*498*).
Frozen	Adriatic		33	0			1935	Morgan, Field, Kimmel, and Nichols (*515*).
	Lob Ingir	[50] (Int.)		3–5				
	Kadota	50 (Int.)	36	3–5				
	Mission	100 (Int.)		0				
Dried			100 (Int.)				1935	Baker and Wright (*31*).
		30					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
				<16			1931	Von Hahn (*263*).
	Unsulphured:							
	Lob Ingir	1/5 of fresh					1932	Morgan, Field, and Nichols (*517*).
	Sun-dried, Adriatic	50 (Int.)	50 (Int.)	0		40	(8)	University of California (Morgan).
	Sun-dried, Adriatic, natural drop	50 (Int.)	73	0		33–50	1935	Morgan, Field, Kimmel, and Nichols (*515*).
	Sun-dried, Mission	50 (Int.)		0		33–50		
	do	1/5 of fresh					1932	Morgan, Field, and Nichols (*517*).
	Sulphured:							
	Lob Ingir	30 percent fresh						
	Sun-dried, Adriatic		23 (Int.)	0		40	(8)	University of California (Morgan).

	Sun-dried, Adriatic, picked		39			33–50	1935	Morgan, Field, Kimmel, and Nichols (*515*).
	Sun-dried, Lob Ingir	70 (Int.)		0		33–50		
	Sun-dried, Adriatic, natural drop		29			33–50		
	Sun-dried, Kadota	51 (Int.)		0		33–50		
	Sun-dried, Mission	78 (Int.)		0		33–50		
	do	1/2 fresh					1932	Morgan, Field, and Nichols (*517*).
	Dehydrated, Lob Ingir	153 (Int.)		0		33–50	1935	Morgan, Field, Kimmel, and Nichols (*515*).
	Dehydrated, Lob Ingir	1/2 fresh					1932	Morgan, Field, and Nichols (*517*).
Fish	Cod. See Codfish.							
	Haddock. See Haddock.							
	Lampern or river lamprey				120 (Int.)		1931	Callow and Fischmann (*95*).
	Lamprey, sea				400 (Int.)			
	Salmon. See Salmon.							
	Sardine. See Sardine.							
	Whiting		30 (Int.)[5]				1935	Baker and Wright (*31*).
Fish liver	Burbot, lake trout and whitefish				Much>beef		1925	Wisconsin Agricultural Experiment Station (*752*).
	Dogfish				160–480 (Int.)		1931	Callow and Fischmann (*95*).
	Lampern or river lamprey				200 (Int.)			
	Lamprey, sea				205–1,020 (Int.)			
Fish fat	Eel	◇Cod-liver oil			◇Cod-liver oil		1927	Rosenheim and Webster (*609*).
	Herring, kippered	6,000–9,000			At least 3,300		1928	Schmidt-Nielsen, S. and S. (634).
Fish-body oil	Catfish, Muddy, Newfoundland				0.4×cod-liver oil		1927	Bills (*54*).
	Dhaln	800–1,000					1934	Datta and Banerjee (*155*).
	Herring				◇Cod-liver oil		1927	Bills (*54*).
	do				◇Newfoundland cod-liver oil.		1930	Drummond and Hilditch (*180*).
	Herring, Alaska	0.1×cod-liver oil			0.3×cod-liver oil		1930	Nelson and Manning (*544*).
	Herring, Maine	0.05×cod-liver oil			0.15×cod-liver oil			
	Hilsa (*Clupea ilisha*)	0					1934	Datta and Banerjee (*155*).
	Lampern or river lamprey	0.08×cod-liver oil			150 (Int.)		1931	Callow and Fischmann (*95*).
	Lamprey, sea	Trace			6,000 (Int.)			
	Menhaden				0.75×cod-liver oil		1927	Bills (*54*).
	do				do		1930	Drummond and Hilditch (*180*).
	do	[3,300–50,000]					1926	Miller, Wohlwend, and Maynard (*503*).
	do				0.75 × cod-liver oil		1930	Nelson and Manning (*544*).
	Mirgal (*Cirrhina mirgala*)	9,000					1934	Datta and Banerjee (*155*).
	Ruhee (*Labeo rohita*)	9,800–10,000						
	Salmon. See Salmon oil.							
	Sardine				◇Cod-liver oil		1927	Bills (*54*).
	do				do		1930	Drummond and Hilditch (*180*).
	do				do		1932	Lachat, Halvorson, and Palmer (*437*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Fish-body oil—Con.	Sardine	0.1×cod-liver oil			do		1930	Nelson and Manning (*544*).
	do				15,500–20,800		1933	Truesdail and Culbertson (*702*).
	Sardine, Pilchard	[10,000]					1931	Finn (*227*).
	Squid				0.06×average cod-liver oil.		1927	Bills (*54*).
	do				0.06×cod-liver oil		1930	Drummond and Hilditch (*180*).
	Tuna	0.1×cod-liver oil			1.25×cod-liver oil		1930	Nelson and Manning (*554*).
	do				12,500–20,800		1933	Truesdail and Culbertson (*702*).
Fish-liver oil	Angler				◇Newfoundland cod-liver oil.		1927	Bills (*54*).
	Angler or Monk (*Lophius piscatorius*).	0.5×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
	Burbot				8–16× cod-liver oil		1929	Clow and Marlatt (*111*).
	do				◇Cod-liver oil		1932	Lachat, Halvorson, and Palmer (*437*).
	do	¾ cod-liver oil					1922	McCollum, Simmonds, Becker, and Shipley (*459*).
	Catfish (*Anarrhichas lupus*)	1.5×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
	Coalfish				0.4×Newfoundland cod-liver oil.		1927	Bills (*54*).
	do	Slightly> cod-liver oil			do		1930	Drummond and Hilditch (*180*).
	Coalfish or Saithe (*G. virens*)	Slightly>2×cod-liver oil.					1933	Lovern, Edisbury, and Morton (*454*).
	Coalfish. See also Pollack.							
	Cod. See Cod-liver oil.							
	Dab (*Pleuronectes limanda*)	0.4×cod-liver oil					1927	Bills (*54*).
	Dogfish				0.03×cod-liver oil		1927	Brocklesby (*80*).
	do	5–10×cod-liver oil					1929	Brocklesby (*81*).
	do				0.1–0.3×cod-liver oil		1931	Callow and Fischmann (*95*).
	do	11–20×cod-liver oil			398–967 (Int.)		1930	Drummond and Hilditch (*180*).
	do				0.03×cod-liver oil		1931	Poulsson (*574*).
	do	2×cod-liver oil					1934	Kawai and Yoshida (*383*).
	Dogfish, aburatsunozame (*Squalus Wakiyea Tanaka*), Japanese, 3 samples.				1,300		1930	Schmidt-Nielsen, S. and S. (*635*)
	Dogfish, spiny (*Squalus acanthias*), adult females.				1,000–2,500			
	Dogfish, spiny (*S. acanthias*), young males.				3,000			
	Eel (*Conger vulgaris*)	6×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
	Flatfish (*Platysomatichthys hippoglossoides*), Newfoundland.	◇Cod-liver oil						
	Goosefish. See Angler.							

Haddock				0.1×cod-liver oil		1927	Bills (*54*).
do				0.1×Newfoundland cod-liver oil.		1930	Drummond and Hilditch (*180*).
do	0.13–0.2×cod-liver oil					1921	Zilva and Drummond (*766*).
Haddock (*G. aeglefinus*)	0.1×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
Hake (*Merluccius vulgaris*)	◇Cod-liver oil						
Halibut. See Halibut-liver oil.							
Herring	[>50,000]					1930	Ahmad and Drummond (*8*).
Katol (*Catla buchanani*)	0					1934	Datta and Banerjee (*155*).
Lampern or river lamprey				5,300 (Int.)		1931	Callow and Fischmann (*95*).
Lamprey, sea				4,400–5,000 (Int.)			
Ling (*Molva vulgaris*)	Slightly <0.4×cod-liver oil.					1933	Lovern, Edisbury, and Morton (*454*).
Ling	2,000,000					1933	Bailey (*30*).
do	◇Cod-liver oil					1922	Zilva and Drummond (*767*).
Madara (*Gadus macrocephalus*), Japanese, 11 samples.				10,000–40,000		1934	Kawai and Yoshida (*383*).
Monk. See Angler.							
Pike (*Esox lusclus*)	2×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
Plaice	◇Cod-liver oil					1922	Zilva and Drummond (*767*).
Plaice (*P. platessa*)	2.5×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
Pollack	◇Cod-liver oil					1922	Zilva and Drummond (*767*).
Pollack, lythe (*G. pollachius*)	do					1933	Lovern, Edisbury, and Morton (*454*).
Pollack. See also Coalfish.							
Puffer				15×cod-liver oil		1927	Bills (*54*)
do				do		1926	Hess and Weinstock (*313*).
Rabbit fish (*Chimaera monstrosa*)				400–500		1930	Schmidt-Neilsen, S. and S. (*635*).
Ratfish	3,330					1929	Norris and Danielson (*549*).
Ratfish (*C. mirabilis*)	0.2×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
Ray (*Raja fullonica*)				10,000–25,000		1930	Schmidt-Neilsen, S. and S. (*635*).
Ray, sharp-nosed (*R. oxyrrhynchus*).				10,000–25,000			
Salmon. See Salmon-liver oil.							
Shark				0.75×cod-liver oil		1927	Bills (*54*).
do				do		1930	Drummond and Hilditch (*180*).
do				0.66×cod-liver oil		1922	McCollum, Simmonds, Becker, and Shipley (*459*).
do	8×cod-liver oil			0.1×cod-liver oil		1931	Poulsson (*574*).
do	◇Cod-liver oil					1922	Zilva and Drummond (*767*).
Shark (*Carcharinus*), West Indian	>100,000					1933	Asenjo (*19*).
Shark, 2 females, specific gravity 0.9116.	Slightly >1,330,000					1935	Asenjo, Dalman, and Axtmayer (*20*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Fish-liver oil—Con.	Shark, black, spiny (*Etmopterus spinax*).	30,000			1,000			
	Shark, females, with young	150,000			1,000–2,500			
	Shark, herring (*Lamna cornubica*), old males.	50,000–100,000			20,000–50,000		1930	Schmidt-Nielsen, S. and S. (*635*).
	Shark, ice or Greenland (*Somniosus microcephalus*).	250,000			500			
	Shark, leopard	270,000			<14,000		1935	Jones and Christiansen (*371*).
	Shark, sawfish	222,200			14,000		1935	Do.
	Shark, sun or Giant (*Cetorhinus maximus*).				5,000		1930	Schmidt-Nielsen, S. and S. (*635*).
	Skate	◇Cod-liver oil					1922	Zilva and Drummond (*767*).
	Skate, blue (*Raja batis*)	Slightly <0.2×cod-liver oil.						
	Skate, Thornback (*R. clavata*), small specimens.	0.25×cod-liver oil						
	Skate, Thornback (*R. clavata*), large specimens.	Slightly>cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
	Sole, Lemon (*P. microcephalus*)	Slightly <2×cod-liver oil.						
	Sturgeon (*Acipenser attilus*)	20×cod-liver oil						
	Sukesodara (*Theragra chalcogramma*), 8 samples, Japanese.				1,250–10,000			
	Sukesodara (*T. chalcogramma*), special sample, Japanese.				100,000		1934	Kawai and Yoshida (*383*).
	Swordfish	4,500,000–7,500,000 (Int.)			700,000–950,000 (Int.).		(8)	United States Department of Com., Bureau of Fisheries.
	Torsk, tusk (*Brosmius brosme*)	2×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
	Tuna, oil content 4 percent of liver				750,000 (Int.)		1934	Bills, Imboden, and Wallenmeyer (*57*).
	Tuna, Blue fin (*Thunnus thynnus*)				40,000 (Int.)		1934	Bills, Massengale, and Imboden (*58*).
	Turbot (*Psetta* (*Rhombus*) *maximus*).	7.5×cod-liver oil						
	Whiting (*G. merlangus*)	0.1×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
Stored	Shark, sun or Giant (*Cetorhinus maximus*) stored under CO_2:							
	1 year	5–10 percent fresh						
	4 to 5 years				Same as fresh		1930	Schmidt-Nielsen, S. and S. (*635*).
Fish visceral oil	Catfish, channel				0.06×cod-liver oil		1927	Bills (*54*).
Fish roe	See Roe.							

Flour	Refined white, or patent	0					1933	Fraps and Treichler (*234*).
	do		Trace				1932	Kansas Agricultural Experiment Station (Kramer). (*94*).
	Whole wheat. See Wheat.							
Garlic (*Allium sativum*).				Trace			1934	Jarussowa and Janowskaja (*357*).
Ghee	Prepared in usual way	[50]					1933	Grewal (*250*).
	Winter	<Summer						
Stored	During summer	Same as fresh						
Gooseberry (*Ribes* spp.).				50			1931	Von Hahn (*263*).
Grape (*Vitis* spp.)	Amur, wild			0			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	Concord	66					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	Concord, purchased on Washington, D. C., market.	11–14	Trace	0		0	1932	Daniel and Munsell (*150*).
	Malaga, purchased on Washington, D. C., market.	21	11–13	<6		0	1932	Daniel and Munsell (*149*).
	Spanish			<10			1931	Von Hahn (*263*).
	Spanish, green			[0]			1918	Chick and Rhodes (*103*).
	Sultanina (Thompson Seedless), purchased on Washington, D. C., market.	21	12–14	8–9		Trace	1932	Daniel and Munsell (*149*).
	Thompson Seedless [Sultanina]	50 (Int.)	33	3			1935	Morgan, Kimmel, Field, and Nichols (*520*).
	Tokay	50					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	Green, pulp		Trace				1935	Baker and Wright (*31*).
	White Catalane		0				1934–35	Vacca (*706*).
	Dark		0					
Frozen	Thompson Seedless [Sultanina]	25 (Int.)	12	Gradual loss			1935	Morgan, Kimmel, Field, and Nichols (*520*).
Dried	See Raisin.							
Grape juice				[4]			1918	Chick and Rhodes (*103*).
	Black		0				1934–35	Vacca (*706*).
Stored	Bottled, Concord	0	Trace	0		0	1932	Daniel and Munsell (*149*).
	Bottled, ⅓ Flame Tokay, ⅔ Zinfandel.	0	0–trace	0		0		
	In barrels, without fermentation or oxidation.			0			1933	Cahill (*92*).
Fermented			0				1934–35	Vacca (*706*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Grapefruit (*Citrus grandis*):		0	[14]*	[26–43]			1932	Eddy, Gurin, and Kohman (*196*).
				50–70			1930	MacLeod and Booher (*469*).
	Early Marsh, from University Farm, Ariz.		16			40	1935	Roehm (*598*).
	Pulp		40 (Int.)				1935	Baker and Wright (*31*).
Stored	2 months, 15° C			Same as fresh			1931	Bracewell and Zilva (*76*).
	More than 2 months, 15° C			Slightly <fresh				
Grapefruit juice				50			1933	Conn and Johnson (*116*).
				77			1935	Fellers (*217*).
				66			1932	Fellers and Isham (*220*).
				50–70			1930	MacLeod and Booher (*469*).
		0					1924	Morgan and Chaney (*512*).
	Duncan and Marsh, from British Honduras.			60–100			1931	Bracewell and Zilva (*76*).
	Florida [Seedlings] and Marsh from South Africa.			60–100				
Frozen and stored	Whole or centrifuged			Same as fresh			1933	Conn and Johnson (*116*).
Grapefruit peel	Early Marsh, from University Farm, Ariz.		28			100	1935	Roehm (*598*).
Grapefruit peel and pulp:								
Dried		<500					1933	Fraps and Treichler (*234*).
Grapefruit peel oil		0					1924	Morgan and Chaney (*512*).
		Trace					1927	Willimott and Wokes (*738*).
Grass:								
Fresh	Brome, smooth (*Bromus inermis*)	39,600±2,700 [5]					1935	Woods, Atkeson, Shaw, Slater, and Johnson (*755*).
	do	27,100±2,000						
	Fescue, meadow (*Festuca elatior*)	25,000±1,300 [5]						
	do	9,600±2,100						
	Kentucky blue (*Poa pratensis*)	10,000					1932	Woods, Shaw, Atkeson, and Johnson (*758*).
	Orchard (*Dactylis glomerata*)	27,500±1,300 [5]					1935	Woods, Atkeson, Slater, Arndt, and Johnson (*756*).
	do	12,100±1,300						
Guava (*Psidium guajava*).	Seeded	200 (Int.)	14 (Int.)	300		35	1936	Miller, Bazore, and Robbins (*498*).
	Paste	1,000					(8)	Puerto Rico School of Tropical Medicine (Cook).
Guava juice				100			1936	Miller, Bazore, and Robbins (*498*).

Guava jelly				60			1936	Do.
Haddock		Trace					(5)	Columbia University (Rice). (See Rice and Munsell, 1931.) (591).
Haddock oil	See Fish-liver oil.							
Halibut-liver oil		3,750,000–6,250,000			200,000–333,000		1932	Emmett, Bird, Nielsen, and Cannon (208).
		Very variable					1932	Lovern (453).
	5 samples	3,000,000 (Int.)					1935	Coward and Morgan (133).
	10 samples	36,000,000 (Int.).			200,000 (Int.) 400,000 (Int.).			
	Hippoglossus hippoglossus				1,200 (Int.)		1934	Bills, Massengale, and Imboden (58).
	H. vulgaris	4–250 × cod-liver oil					1933	Lovern, Edisbury, and Morton (454).
	Jan., oil 12 percent of liver	24,000,000 (Int.)			140,000 (Int.)		1934	Bills, Imboden, and Wallenmeyer (57).
	Aug., oil 25 percent of liver	3,500,000 (Int.)			90,000 (Int.)			
	From old fish	>From young fish					1933	Lovern and Sharp (456).
Hazelnut (*Corylus* spp.).			200 (Int.)				1935	Baker and Wright (31).
			[220]				1929	Plimmer, Raymond, and Lowndes (562).
Heart	Beef					300	1931	Day (158).
	do		100				1934	Pierson (561).
	Lamb		200–300					
	Mutton		[88]				1933	Plimmer, Raymond, and Lowndes (565).
Hegari		30					1930	Smith (658).
Hempseed oil		0			0		1935	Lo (451).
Herring oil	See Fish oils.							
Hip berry (rose hips): Dried				2,000			1934	Lund, Spur, and Fridericia (458).
Hominy	White	0					1933	Fraps and Treichler (234).
	Yellow	830						
Hominy grits	See also Corn endosperm. See Corn endosperm.							
Honey		[0]	[0]	[0]	[0]	[0]	1929	Hoyle (342).
		0	0 *	0	0		1929	Kifer and Munsell (391).
		0	0	0	0		1932	Trautmann and Kirchhof (699).
Honeycomb		0	0		0		1929	Kifer and Munsell (391).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Horseradish (*Armoracia rusticana*)				100			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
				200			1931	Von Hahn (*264*).
Jerusalem-artichoke (*Helianthus tuberosus*)			[55]				1931	Plimmer, Raymond, and Lowndes (*564*).
			150			0	1934	Reder (*588*).
Kafir grain (*Holcus sorghum*):	Black	30					1933	Fraps and Treichler (*234*).
	Red	40						
	White	50						
Germinated				[5–7]			1921	Delf (*163*).
Kale (*Brassica oleracea acephala*)						193	(8)	Columbia University (Douglass).
		32,000–34,900					(8)	Columbia University (Rice and Bessey).
			[50]				1929	Kentucky Agricultural Experiment Station (*122*).
		20,000					1934	Sherman and Todhunter (*647*).
Kidney	Veal					800–1,000	1931	Day (*158*).
	Beef					800–1,000		
	Lamb	833					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	Mutton		[88]				1933	Plimmer, Raymond, and Lowndes (*565*).
	do		190 (Int.)				1935	Baker and Wright (*31*).
	Pig		340 (Int.)					
Kohlrabi (*Brassica oleracea gongylodes*)				100			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
				>200			1931	Von Hahn (*264*).
			[20]*				1930	House, Nelson, and Haber (*341*).
				[>100]			1927	Scheunert (*631*).
Lambsquarters (*Chenopodium album*)		[13,600]					1934	Kramer and Oberhelman (*414*).

Lard		0–trace					1920	Drummond, Golding, Zilva, and Coward (*179*).
		[0]					1933	Fraps and Treichler (*234*).
		0					1922	Mallon and Clark (*473*).
					0		1933	Read and Bailey (*586*).
		Trace					1927	Shimoda and Saiki (*651*).
Leek (*Allium porrum*).			[55]				1933	Plimmer, Raymond, and Lowndes (*565*).
	Green			25			1931	Von Hahn (*264*).
	White			20				
Dried			[110]				1931	Plimmer, Raymond, and Lowndes (*564*).
Lemon juice (*Citrus limonia*):				83–100			1933	Bessey and King (*47*).
				[67]			1921	Davey (*157*).
				[67]			1925	Delf (*166*).
	Freshly extracted			100			1934	Joslyn, Marsh, and Morgan (*373*).
	Messina			65			1934	Lund, Spur, and Fridericia (*458*).
	From fruit purchased on open market.	0					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
	do			53			(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	do			67			(8)	Washington Agricultural Experiment Station (Batchelder).
	From stored lemons:							
	1 month open, laboratory, from Malaga, Spain.			Same as fresh				
	1 month open, laboratory, from Italy.			82 percent fresh			1934	Bacharach, Cook, and Smith (*29*).
	1 month open, laboratory, from Cape Colony.			Same as fresh				
	9 months, 2.5° to 5.4° C.			do			1921	Davey (*157*).
	Strained through muslin			do				
Frozen and stored	1 year 5 months			do			1925	Delf (*166*).
	5 years			0 5×fresh				
Dried	Spray process, reconstituted			Same as fresh			1924	Cavanaugh, Dutcher, and Hall (*96*).
Lemon juice and rind oil:	Whole fruit minced and strained			[67]			1921	Davey (*157*).
Stored	Whole fruit minced and strained, 3 months, 0° C. or room temperature.			Same as fresh				

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Lentil (*Lens esculenta*).			210 (Int.)				1935	Baker and Wright (*31*).
			40 (Int.)			[75]	1934	Ghosh and Guha (*238*).
Lettuce (*Lactuca sativa*).			90 (Int.)				1935	Baker and Wright (*31*).
						69	(8)	Columbia University (Douglass).
				7			(8)	Columbia University (Quinn). (See Rice and Munsell, 1931.) (*591*).
		[1,850]					1927	Dye, Medlock, and Crist (*191*).
	Leaf		[66]			[40]	1930	Roscoe (*601*).
	do					100	(8)	University of Tennessee (Woodson).
	Leaf, Grand Rapids forcing	[2,130]					1929	Dye and Crist (*190*).
	Leaf, hothouse		[36]*				1930	House, Nelson, and Haber (*341*).
	Leaf, Grand Rapids forcing, outdoor.		[48]*					
	Head, whole	[500]					1927	Dye, Medlock, and Crist (*191*).
	do			<33			1931	Von Hahn (*264*).
	do			50–100			1929	Scheunert (*632*).
	Head, whole, "Iceberg" [New York] mixture green and white.	167					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
	Head, green outer leaves	[680]					1927	Dye, Medlock, and Crist (*191*).
	do			4			1931	Kohman, Eddy, and Gurin (*404*).
	do	5,000–6,600					1929	Kramer, Boehm, and Williams (*412*).
	Head, green outer leaves, "Iceberg" [New York].	3,670	24	5–7		46	1935	Munsell and Kennedy (*535*).
	Head, bleached inner leaves			4			1931	Kohman, Eddy, and Gurin (*404*).
	do	166					1929	Kramer, Boehm, and Williams (*412*).
	Head, bleached inner leaves, "Iceberg" [New York].	114	30	5–7		24	1935	Munsell and Kennedy (*535*).
	Romaine	300					(8)	Columbia University (Rice). (See Rice and Munsell, 1931) (*591*).
	do	1,200					(8)	Columbia University (Rice and Bessey).

Lime juice (*Citrus* spp.):	Sweet [*C. limetta*]			>Sour			1921	Davey (*157*).
	Sour, West Indian [*C. aurantifolia*]			[20]				
	Egyptian			[66]			1932	Hassan and Basili (*284*).
Stored	Refrigerated 2 months			<50 percent fresh				
Linseed oil		0			0		1935	Lo (*451*).
Liver	Calf				0		1935	Coward and Morgan (*133*).
	do					800–1,000	1931	Day (*158*).
	do				10 (Int.)		1935	DeVaney and Munsell (*167*).
	do	7,300					1934	Sherman and Todhunter (*647*).
	Beef					1,000	1931	Day (*158*).
	do				47 (Int.)		1935	DeVaney and Munsell (*167*).
	do		[77]				1933	Plimmer, Raymond, and Lowndes (*565*).
	Chicken. See Chicken liver.							
	Lamb				17 (Int.)		1935	DeVaney and Munsell (*167*).
	Pig				44 (Int.)			
	do	8,000					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
Dried	Beef					[2,500–5,000]	1929	Aykroyd and Roscoe (*27*).
	do					1,580	1935	Morgan and Hunt (*519*).
	do		[>500]			2,500	1931	Roscoe (*603*).
Liver fat	Calf, beef, or sheep	10 × Newfoundland cod-liver oil or 200–1,000 × butterfat.					1927	Rosenheim and Webster (*609*).
Lychee (lichi or litchi) (*Nephelium litchi*).			14 (Int.)			0	1934	Ghosh and Guha (*238*).
Maize	See Corn.							
Malayapple (mountain apple) (*Eugenia malaccensis*).			2 (Int.)			[6]	1934	Do.
		25	11	5		16	1934	Miller, Robbins, and Haida (*501*).
Malt:								
Green	See Barley, germinated.							
Kilned				0			1924	Harden and Zilva (*271*).
			[110]				1931	Plimmer, Raymond, and Lowndes (*563*).
				[0]			1927	Randoin and Lecoq (*581*).
		0		0			1924	Southgate (*661*).
Mamey (*Mammea americana*).		40					1933	Axtmayer and Cook (*24*).
Mandarin orange juice.	See Orange juice.							

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Mango (*Mangifera indica*):	Pulped flesh	2,500					(8)	Puerto Rico School of Tropical Medicine (Cook).
	Bombaii		14 (Int.)			[99]	1934	Ghosh and Guha (*238*).
	Fozli		33 (Int.)			[90]		
	Langra		16 (Int.)			[105]		
Frozen	Alphonse	[2,000]		100–200	0		1932	Perry and Zilva (*559*).
	do	<Butter		2,000–3,000 (Int.)	0		1933	Crawford and Perry (*140*).
	Cowasji Patel	Slightly<2,000		67–100	0		1932	Perry and Zilva (*559*).
	do	0.5×butter		1,500–2,000 (Int.)	0		1933	Crawford and Perry (*140*).
	Shendria	Slightly<2,000			0		1932	Perry and Zilva (*559*).
	do	0.5×butter		200 (Int.)	0		1933	Crawford and Perry (*140*).
Mango rind				200			1932	Perry and Zilva (*559*).
	Alphonse			100–200				
Maple sugar		Trace					1934	Fellers and Smith (*224*).
Maple sap (sirup)				0			1934	Do.
Margarine	17 samples	0–trace					1935	Hathaway and Davis (*286*).
		44						
	Vegetable oils	110					1933	Poe and Fehlmann (*567*).
	11 samples, nut margarines	0–trace					(9)	Puerto Rico School of Tropical Medicine (Cook).
Marjoram (*Origanum vulgare*).		3,300						
Marrow bone		810 (Int.)					1935	Coward and Morgan (*133*).
"Melon pear"	See Pepino.							
Menhaden oil	See Fish-body oil.							
Milk, cow's	Colostrum. See Colostrum.							
Milk, cow's, whole					0		1929	Coward (*125*).
			23 (Int.)				1935	Baker and Wright (*31*).
						[48–96]	1929	Aykroyd and Roscoe (*27*).
				[1]			1919	Barnes and Hume (*38*).
				<3			1933	Bessey and King (*47*).
						50	1933	Booher (*68*).
				[Slightly>1]			1918	Chick, Hume, and Skelton (*102*).
		280–320 (Int.)					1935	Coward and Morgan (*133*).
			[50]			[100]	1934	Dutcher, Guerrant, and McKelvey (*187*).
					5		1932	Hess, Light, Frey, and Gross (*307*).
					[4–5]		1927	Hess and Weinstock (*314*).
				1–2			1927	Hottinger (*339*).

			[<1]			1922	Johnson and Hooper (*363*).
					Varies with diet of cow.	1935	Hunt and Perkins (*347*).
					[50]	1931	Roscoe (*603*).
			2–3			1928	Saleck (*624*).
				10		1934	Olson (*551*).
20 samples				0–10 (Int.)		1935	Coward and Morgan (*133*).
Jersey	470–610 (Int.)						
May to June			2	3 (Int.)		1935	Fellers (*217*).
October to November				2 (Int.)			
Grade A, May and June	133					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
Grade B, September and October	200						
Cows on pasture				>Winter		1920	Dutcher, Eckles, Dahle, Mead, and Schaefer (*185*).
do			[2]			1920	Hart, Steenbock, and Eliis (*280*).
do				>Dry feed		1920	Hess, Unger, and Supplee (*311*).
Cows on pasture, Holstein, Guernsey, and Shorthorn.		14–20*				1932	Gunderson and Steenbock (*269*).
Cows on young pasture		>Overmature			>Overmature	1931	Hunt and Krauss (*346*).
do			<1–2			1932	Szlendakowa (*687*).
Cows on young pasture, Holstein and Guernsey.			<3			1931	Schwartze, Murphy, and Cox (*636*).
Cows on pasture, August to October.	[330–500]			[20–50]		1924	Luce (*456*).
Cows on dry feed			<Pasture fed			1919	Barnes and Hume (*38*).
	96					1927	Dutcher, Honeywell, and Dahle (*188*).
		◇Pasture fed			<Pasture fed	1931	Hunt and Krauss (*346*).
			[1]			1920	Hart, Steenbock, and Ellis(*280*).
				Slightly <5		1930	Honeywell, Dutcher, and Dahle (*337*).
			3			1922	Hunt and Winter (*348*).
				5–6		1932	Mitchell, Eiman, Whipple, and Stokes (*507*).
				[8]		1925	Steenbock, Hart, Hoppert, and Black (*668*).
			<Pasture fed			1932	Szlendakowa (*687*).
Apr. 14 to May 13				6		1934	Krauss, Bethke, and Wilder (*418*).
Aug. 12 to Sept. 12				6			
In the dark, November to May	[120]			[5–7]		1924	Luce (*456*).
Holstein, Guernsey, and Shorthorn.		◇Pasture fed				1932	Gunderson and Steenbock (*260*).
Plus green leafy alfalfa, Holstein.				2–3		1933	Krauss, Bethke, and Wilder (*417*).
Plus green fodder, in the dark, June to July.	[Increases from 100→330]			[5–8]		1924	Luce (*456*).
Plus alfalfa hay and good silage.			2			1927	MacLeod (*464*).
do	130–200	12			34–37	1932	MacLeod, Brodie, and Macloon (*467*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Milk, cow's, whole—Contd.	Cows on dry feed or silage			<Pasture fed			1936	Riddell, Whitnah, Hughes, and Lienhardt (*594*).
	Cows receiving no sunshine				3/5 normal		1934	South Dakota Agricultural Experiment Station (Olson). (*551*).
	Freshly drawn			Decreases with standing.			1933	Bleyer (*64*).
	do			do			1933	Kon (*407*).
	Beginning of lactation period	>End of period					1934	Fraps, Copeland, and Treichler (*230*).
	do		Same as at end				1932	Gunderson and Steenbock (*260*)
	Cows of different breeds: Undifferentiated		Same for all					
	Jersey:							
	6.2 percent fat, February	[330]						
	Adjusted to 3.5 percent fat, January.	[67]						
	Adjusted to 3.7 percent fat, March.	[100]						
	Adjusted to 3.5 percent fat, June.	[172]						
	5.3 percent fat, June	[227]						
	Holstein:							
	3.25 percent fat, November	[110]						
	3.5 percent fat, January	[72]					1933	Hathaway and Davis (*285*).
	3.7 percent fat, March	[155]						
	3.4 percent fat, April	[154]						
	3.4 percent fat, May	[200]						
	Ayrshire:							
	Adjusted to 3.4 percent fat, April.	[77]						
	Adjusted to 3.4 percent fat, May.	[156]						
	Guernsey:							
	4.6 percent fat, June	[238]						
	Adjusted to 3.5 percent fat, June.	[185]						
	Cows receiving additional vitamin D:							
	Zucker's cod-liver oil concentrate:							
	6,000 units daily				5		1933	Krauss, Bethke, and Wilder (*417*).
	15,000 units daily				10			
	40,000 units daily				18			
	60,000 units daily				28			

Irradiated ergosterol:							
60,000 units daily				37–42		1934	Russell, Wilcox, Waddell, and Wilson (*616*).
60,000 units daily, May 13 to June 6.				77		1934	Krauss, Bethke, and Wilder (*418*).
100,000 units daily				80		1931	Hess, Lewis, MacLeod, and Thomas (*305*).
120,000 units daily, Sept. 12 to Oct. 12.				89		1934	Krauss, Bethke, and Wilder (*418*).
180,000 units daily				127–137		1934	Russell, Wilcox, Waddell, and Wilson (*616*).
200,000 units daily				160			
Irradiated yeast:							
30,000 units daily				80		1931	Hess, Lewis, MacLeod, and Thomas (*305*).
60,000 units daily				160			
----do				37–42		1934	Russell, Wilcox, Waddell, and Wilson (*616*).
May 13 to June 6				118		1934	Krauss, Bethke, and Wilder (*418*).
100,000 units daily				138–211			
Containing 3,500 units of vitamin B.		16 (◇nonyeast fed cows).		125		1932	Hess, Light, Frey, and Gross (*307*).
120,000 units daily, Sept. 12 to Oct. 12.				141		1934	Krauss, Bethke, and Wilder (*418*).
180,000 units daily				159		1934	Russell, Wilcox, Waddell, and Wilson (*616*).
200,000 units daily				160		1932	Mitchell, Eiman, Whipple, and Stokes (*507*).
30D, 10 ounces 7 a. m., milk tested same evening.				28			
30D, 10 ounces 7 a. m., milk tested next evening.				21		1934	Light, Wilson, and Frey (*449*).
30D, 10 ounces 7 a. m., milk tested third evening.				13			
Sunlight:							
----------				Slightly>no sunlight		1930	Steenbock, Hart, Riising, Hoppert, Basherov, and Humphrey (*669*).
Various amounts				----do		1924	Luce (*457*).
July to October, ration deficient in vitamins A and D.	[Decreases from 500→120].					1924	Luce (*456*).
Cows irradiated				◇Nonirradiated		1930	Steenbock, Hart, Riising, Hoppert, Basherov, and Humphrey (*669*).
15 minutes daily, dry feed ration.				20		1932	Mitchell, Eiman, Whipple, and Stokes (*507*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Milk, cow's, whole—Contd.								
Pasteurized		180					1933	Cook and Axtmayer (*118*).
			77 percent raw			86 percent raw	1934	Dutcher, Guerrant, and McKelvey (*187*).
			Same as raw*				1921	Johnson (*362*).
				[0]			1922	Johnson and Hooper (*363*).
		Same as raw	<Raw	<Raw			1930	Pratt (*578*).
				10–80 percent raw [9]			1931	Schwartze, Murphy, and Cox (*636*).
						68	1932	Todhunter (*697*).
	Autumn			>1–<2	2 (Int.)		1935	Fellers (*217*).
	In aluminum pipes, 161° to 163° F., 16 to 17 seconds.			Same as raw			1934	King and Waugh (*395*).
	In open vat, 143° to 145° F., 30 minutes.			0				
Frozen				<2			1928	Saleek (*624*).
Frozen and stored	6 months at −4° C		Same as fresh				1932	Samuels and Koch (*627*).
Evaporated				0			1919	Hart, Steenbock, and Smith (*283*).
		424					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
						132	1932	Todhunter (*697*).
	Reconstituted		Same as raw				1926	Dutcher, Francis, and Combs (*186*).
	do				<Raw		1930	Honeywell, Dutcher, and Dahle (*337*).
	do		80 percent raw			Same as raw	1932	Samuels and Koch (*627*).
	Reconstituted, vacuum or aeration process.	Slightly <raw					1927	Dutcher, Honeywell, and Dahle (*188*).
Dried		555–2,000					(8)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
		660–1,000					1933	Fraps and Treichler (*234*).
		1,000					1933	Fraps and Treichler (*232*).
						488	1935	Morgan and Hunt (*519*).
			200–250			1,250	1932	Wan (*712*).
	English, from winter milk					[250]	1931	Guha (*255*).
	Reconstituted			[0]			1919	Barnes and Hume (*38*).
	do			[1]			1919	Hess and Unger (*310*).
	Reconstituted, dried by spray process.			Same as raw			1924	Cavanaugh, Dutcher, and Hall (*96*).
	do		Same as raw*				1921	Johnson (*362*).
	do			[<1]			1922	Johnson and Hooper (*363*).
	do			[<1]			1926	Supplee and Dow (*675*).

	Reconstituted, dried by vacuum process, sweetened.			Same as raw			1927	Hottinger (*339*).
	Reconstituted, unsweetened			[0]				
Dried and stored	9 months	⅓ fresh dried					1933	Fraps and Treichler (*232*).
Milk, cow's, skim		∝ Fat content			∝ Fat content		1930	Crawford, Golding, Perry, and Zilva (*139*).
					[1]		1927	Hess and Weinstock (*314*).
	Jersey, 0.01 percent fat, February	[3]					1933	Hathaway and Davis (*235*).
	Holstein, 0.03 percent fat, November.	[0–trace]						
Dried		0					(3)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
						636	1932	Halliday (*267*).
			200–250				1932	Halliday (*268*).
			[110]				1933	Plimmer, Raymond, and Lowndes (*565*).*
			[140–150]*				1923	Sherman and Spohn (*646*).
	Reconstituted		[14–15]*					
Milk, goat's, whole			25–30*				1932	Gunderson and Steenbock (*260*).
				<Raw cows'			1924	Meyer and Nassau (*490*).
	Goats on pasture	100	50	2–3	30	[33]	(3)	United States Department of Agriculture, Bureau of Animal Industry (Ellis).
	Goats on dry feed	150	33	<2	15	[33]		
	do			3–5			1922	Hunt and Winter (*348*).
	do				[8]		1925	Steenbock, Hart, Hoppert, and Black (*668*).
	Goats irradiated 30 minutes daily, 4 to 17 days.				3–6 × nonirradiated			
	Goats irradiated 1 hour daily, 1 to 8 days.				1.5–3 × nonirradiated.			
Milk, human, whole				2–4 × cows'			1933	Bleyer (*64*).
					[0]		1933	Bunker, Harris, and Eustis (*88*).
						19–33	1932	Donelson and Macy (*171*).
			10			20	1934	Donelson and Macy (*172*).
					[3–4]		1927	Hess and Weinstock (*314*).
		Same as cows'					1927	Macy, Outhouse, Graham and Long (*471*).
					[0]		1928	Outhouse, Macy, and Breckke (*554*).
					Same as cows'		1932	Sabri and Fikry (*619*).
	Women receiving extra vitamin B and G (yeast).		10			30	1934	Donelson and Macy (*172*).
	Women receiving 15 g cod-liver oil daily.	Same as unsupplemented.					1934	McCosh, Macy, Hunscher, Erickson, and Donelson (*460*).
	Women receiving milk containing 300 units vitamin D (cod-liver oil concentrate).				Same as unsupplemented.		1934	Barnes, Cope, Hunscher, and Macy (*37*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Milk, human, whole—Contd.	Women receiving 24 ounces vitamin D milk daily, 2 weeks.				6		1933	Bunker, Harris, and Eustis (*88*).
	Woman irradiated				>Nonirradiated		1926	Hess, Weinstock, and Sherman (*316*).
Millet seed (*Chaetochloa italica*).			[143]				1931	Plimmer, Raymond, and Lowndes (*563*).
Molasses	Cane		0				1930	Nelson and Jones (*543*).
	do		[0]				1927	Randoin and Lecoq (*582*).
Mountain apple	See Malayapple.							
Mountain-ash berry (*Sorbus* spp.).				400			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
Mushroom			50 (Int.)				1935	Baker and Wright (*31*).
		0					(6)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
				<10			1931	Von Hahn (*264*).
					0		1929	Mellanby, Surie, and Harrison (*487*).
				0			1931	Scheunert and Reschke (*633*).
				0			1924	Steidle (*672*).
Muskmelon (*Cucumis melo*).	Cantaloup	440	<25	33			1931	Newton (*548*).
	do	400					(6)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
			6 (Int.)			[30]	1934	Ghosh and Guha (*258*).
Mustard oil		0					1934	Brahmachari (*77*).
		0			0		1935	Lo (*451*).
Mutton	Lean		60 (Int.)				1935	Baker and Wright (*31*).
Mutton fat		0.2×butter					1920	Drummond and Coward (*178*).
Nectarine (*Amygdalus persica nectarina*).	White, Stanwick	Trace					1933	Smith and Morgan (*656*).
	Yellow, Humboldt	2,000						

Oats (*Avena sativa*)	Seed			0			1918	Cohen and Mendel (*115*).
	do		[135]				1931	Hetler, Meyer, and Hussemann (*323*).
	do	0–trace					1931	Meyer and Hetler (*489*).
	do	0–trace					1927	Steenbock and Coward (*666*).
Oatmeal		0					(8)	Columbia University (Munsell).
		0					1933	Fraps and Treichler (*234*).
				[0]			1928	Kucera (*419*).
				[0]			1930	Matsuoka (*482*).
			[121]				1931	Plimmer, Raymond, and Lowndes (*563*).
	Dry		325 (Int.)				1935	Baker and Wright (*31*).
	Breakfast, dry		140 (Int.)[6]					
Oat embryo	Close		[Slightly>400]				1931	Hetler, Meyer, and Hussemann (*323*).
	Rough		[Slightly<300]					
Okra (*Hibiscus esculentus*):		600					1933	Axtmayer and Cook (*24*).
Dried		300					1933	Fraps and Treichler (*234*).
Okra ends:								
Dried	Stem end usually discarded	<200					1933	Do.
Oleo oil					[0]		1927	Bills (*54*).
Olive (*Olea europaea*)	Green, canned	270–290					1932	Kifer (*390*).
	Ripe, Manzanillo	250	Trace	0	0	0		
	Ripe, Mission	90–100						
Olive oil					[0]		1927	Bills (*54*).
					0		1935	Coward and Morgan (*133*).
	Refined	Trace					(5)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	do	0					1929	Javillier and Emerique (*358*).
	do	<Unrefined					1930	Margaillan (*478*).
Onion (*Allium cepa*)			40 (Int.) [6]				1935	Baker and Wright (*31*).
		0					(5)	ColumbiaUniversity(Munsell). (See Rice and Munsell, 1931.) (*591*).
				<20			1931	Von Hahn (*264*).
		[0]					1921	Hume (*345*).
			[15]			[11]	1930	Roscoe (*601*).
Dried			[250–500]			[198]	1931	Roscoe (*603*).
Onion juice	From green onions			33			1934	Schepilewskaja (*629*).
Opihi	Hawaiian shellfish	10,000					1932	Miller (*497*).
	do		25	0	50	130	(5)	Hawaii Agricultural Experiment Station (Miller).

See footnotes at end of table.

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TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Orange (*Citrus* spp.)	Without peel [*C. sinensis*]					20	1933	Day and Darby (*160*).
	do		[100]			[15–30]	1931	Roseoe (*603*).
Dried	Including peel, in dehydrator 155°–175° F., 8 hours.			[250]			1925	Goss (*245*).
	Mandarin (tangerine) [*C. nobilis deliciosa*].			45			1934	Jarussowa (*356*).
Orange Juice	[*C. sinensis*]			[80–100]			1933	Bessey and King (*47*).
				[65]			1918	Chick and Rhodes (*103*).
		65					(3)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
				53			(3)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
						39	(3)	Columbia University (Douglass).
				51			1929	Eddy (*194*).
				83			1935	Fellers (*217*).
				65			1925	Goss (*245*).
				65			1932	Miller (*497*).
				65			1918	Hess and Unger (*309*).
			[66]				1933	Plimmer, Raymond, and Lowndes (*565*).
				65			1936	Miller, Bazore, and Robbins (*498*).
	Freshly extracted			100			1934	Joslyn, Marsh, and Morgan (*373*).
	From California, strained through 7-mesh sieve.					20	1933	Day and Darby (*160*).
	Navel [Washington Navel]			[65]			1921	Delf (*163*).
	do			65			1934	Joslyn, Marsh, and Morgan (*373*).
	From Jaffa			65			1931	Bracewell and Zilva (*76*).
	Valencia, from Puerto Rico or Florida.			65			1933	Conn and Johnson (*116*).
	Spanish			200			1931	Von Hahn (*263*).
	Midseason			65			1921	Davey (*157*).
	Beginning and end of season			Slightly < midseason				
	Oranges from trees sprayed with lead arsenate.			½–⅔ nonsprayed			1932	Nelson and Mottern (*545*).
	Centrifuged			Same as noncentrifuged.			1933	Conn and Johnson (*116*).
	Mandarin (tangerine) [*C. nobilis deliciosa*].			30–50			1921	Delf (*163*).
	do			50			1934	Jarussowa (*356*).

	do			50			1931	Von Hahn (*263*).
	do			53			(*)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	From stored oranges:							
	1 month, open, laboratory, sweet, from Almeria, Spain.			80 percent fresh			1934	Bacharach, Cook, and Smith (*29*).
	1 month, open, laboratory, sweet, from Brazil.			68 percent fresh				
	1 month, open, laboratory, sweet, from Jaffa, Palestine.			90 percent fresh				
	1 month, open, laboratory, sweet, from South Africa.			93 percent fresh				
	1 month, open, laboratory, sweet, seedless, from Tabernas, Spain.			94 percent fresh				
	1 month, open, laboratory, bitter, from Seville, Spain.			86 percent fresh				
	2 months, 15° C., Shamuti, from Jaffa, Palestine.			Same as fresh			1931	Bracewell and Zilva (*76*).
	5 months, 2.5° to 5.4° C., Denia, strained through muslin.			do			1921	Davey (*157*).
	do			do			1925	Delf (*166*).
Stored	3 months, refrigerator, unstrained			0			1932	Koch and Koch (*409*).
Frozen				Same as fresh			1933	Buskirk, Bacon, Tourtellotte, and Fine (*91*).
	Navel [Washington Navel] and Valencia.			65			1934	Joslyn, Marsh, and Morgan (*373*).
Frozen and stored	42 days, Puerto Rican Valencia, filtered through sieve.			Same as fresh			1933	Conn and Johnson (*116*).
	105 days, Florida seedling, overripe fruit.			do				
	115 days, Florida Valencia			do				
	128 days, Florida Pineapple			do				
	159 days, Florida Valencia			do				
	10 months, 0° F., sealed			◇Fresh frozen			1933	Nelson and Mottern (*546*).
	18 months, −12° to −17° C			Same as fresh			1933	Morgan, Langston, and Field (*521*).
	20 months, −26.1° C			do			1933	Buskirk, Bacon, Tourtellotte, and Fine (*91*).
	1½ years, −11° to −14° C			do			1925	Delf (*166*).
	2 years, −12° to −15° C			do			1933	Conn and Johnson (*116*).
	5 years			50 percent fresh			1925	Delf (*166*).
Dried	Spray process, reconstituted			Same as fresh			1924	Cavanaugh, Dutcher, and Hall (*96*).
Orange juice and rind oil:	Total fruit minced and strained			65				
Stored	3 months, 0° C. to room temperature.			Same as fresh			1921	Davey (*157*).
	2 years, 0° C. to room temperature.			Slight loss				
Orange peel			[66]				1931	Plimmer, Raymond, and Lowndes (*564*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Orange pulp			40 (Int.)[5]				1935	Baker and Wright (*31*).
	Tangerine (Mandarin)		40 (Int.)				1933	Conn and Johnson (*116*).
	Residue after extraction of juice, Florida or Valencia.			0				
Orange pulp and peel:								
Dried	Juice removed	300–660					1933	Fraps and Treichler (*234*).
"Orégano"	See Marjoram.							
Oyster	Harvested in October	300	150		5 (Int.)		1935	Whipple (*726*).
Frozen		[>30–<50]	[Slightly >50]		[20]		1928	Jones, Murphy, and Nelson (*367*).
Oyster oil		20,800			340		1935	Whipple (*726*).
Palm oil	Red	○ average cod-liver oil.					1931	Ahmad (*5*).
	do				0–1/30×cod-liver oil		1932	Dann (*153*).
	Very dark	0.3–0.4 × butter					1920	Drummond and Coward (*178*).
	Dark red	[70,000–100,000]					1930	Drummond, Ahmad, and Morton (*177*).
Palm kernel		Trace					1922	Drumond and Zilva (*182*).
Palm kernel oil		[<50]					1922	Do.
Papaya (*Carica papaya*).			[10–14]*				1923	Acuña (*4*).
				10			1921	Delf (*163*).
		Much>20	10*	>30			1926	Miller (*494*).
		3,000 (Int.)	8 (Int.)	70		33	1936	Miller, Bazore, and Robbins (*498*).
Papaya juice				20			1921	Delf (*163*).
Parsley (*Petroselinum hortense*).				53			(8)	Columbia University (Quinn). (See Rice and Munsell, 1931.) (*591*).
				200			1931	Von Hahn (*264*).
		50,000–100,000					(8)	Puerto Rico School of Tropical Medicine (Cook).
Parsnip (*Pastinaca sativa*).			[77]				1933	Plimmer, Raymond, and Lowndes (*565*).
Passion fruit juice (*Passiflora edulis*).				50			1936	Miller, Bazore, and Robbins (*498*).
Pea (*Pisum* spp.)	Green			[33–50]			1933	Bessey and King (*47*).
	do	400–755					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).

	do	[2,140–2,450]	[50] *	[43]	0		1926	Eddy, Kohman, and Carlsso (*200*).
	do			33			1931	Von Hahn (*264*).
	Medium stage of development			>Mature and germinating. >			1933	Von Hahn (*265*).
	Alderman (*P. sativum*)					100	1935	Funnell (*235*).
	Thomas Laxton (*P. sativum*)		200–300					
	Field (*P. arvense*)		40 (Int.)			[240]	1934	Ghosh and Guha (*238*).
Frozen			Same as fresh			Same as fresh	1935	Funnell (*235*).
Frozen and stored			do			do		
	Mixture of Alderman and Thomas Laxton.		½ fresh			do		
Dried	Green	1,250					1933	Fraps and Treichler (*234*).
	do		[140]				1929	Plimmer, Raymond, and Lowndes (*562*).
	do					[100–150]	1931	Roscoe (*603*).
	do			0			1929	Simonik (*653*).
Dried and stored	More than 1 year					Same as fresh	1935	Funnell (*235*).
Germinated				[5–7]			1933	Grianznoff, Aliexeewa, Gorina, and Gorbunova (*251*).
				Slightly < 40			1933	Johnson (*365*).
	6 hours			Detectable amounts			1929	Simonik (*653*).
	14 days		0				1935	Funnell (*235*).
Pea pod				33			1931	Von Hahn (*264*).
Peach (*Amygdalus persica*):				12–20			1921	Delf (*163*).
				16			1931	Von Hahn (*263*).
				17			1926	Kohman, Eddy, Carlsson, and Halliday (*403*).
	White	Much<yellow					1928	Kansas Agricultural Experiment Station (Kramer) (*95*).
	Yellow, Elberta	200						
Frozen	White, Hiley	[>50]		[0]			1931	Newton (*548*).
	White, Mayflower	Trace					1933	Smith and Morgan (*656*).
	Yellow, Elberta	[>50]		[0]			1931	Newton (*548*).
	do	2,000					1933	Smith and Morgan (*656*).
	Yellow, Muir			12			1929	Morgan and Field (*513*).
	do	1,220					1930	Morgan and Field (*514*).
	Mulys Cling		3 (Int.)			18	(8)	University of California (Morgan).
Dried		3,000 (Int.)					(8)	Columbia University (Booher and Williams).
	Unsulphured, sun-dried	2,200 (Int.)	15 (Int.)	0		137	(8)	University of California (Morgan).
	Unsulphured, sun-dried or dehydrated, Muir.			0			1929	Morgan and Field (*513*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Peach—Continued.								
Dried	Unsulphured, sun-dried or dehydrated, Muir.	4,420					1930	Morgan and Field (*514*).
	Sulphured, sun-dried	2,200 (Int.)	8 (Int.)	750 (Int.)		91	(5)	University of California (Morgan).
	Sulphured, sun-dried, Muir			50			1929	Morgan and Field (*513*).
	do	4,420					1930	Morgan and Field (*514*).
	Sulphured, dehydrated, Muir			100			1929	Morgan and Field (*513*).
	do	4,420					1930	Morgan and Field (*514*).
Peach juice				30–50			1921	Delf (*163*).
Peanut (*Arachis hypogaea*).			[220]				1929	Plimmer, Raymond, and Lowndes (*562*).
	Raw		670			200	1932	Sherwood and Halverson (*648*).
Peanut oil					[0]		1927	Bills (*54*).
		0.1 × butter					1920	Drummond and Coward (*178*).
Peanut meal		<50					1933	Fraps and Treichler (*234*).
Pear (*Pyrus* spp.)						50	(5)	Columbia University (Williams and Douglass).
			30 (Int.) [6]				1935	Baker and Wright (*31*).
	Bartlett	Trace	[6] *	[0]			1929	Kramer, Eddy, and Kohman (*413*).
	Bartlett, pulp					100	1933	Day and Darby (*160*).
	Bosc		17			22	1934	Douglass, Halloway, Williams, and Garrison (*174*).
	Burgermeister			16			1931	Von Hahn (*263*).
	Kieffer			7			1927	Craven and Kramer (*138*).
	do		42 *	7			1928	Kansas Agricultural Experiment Station (Kramer) (*93*).
	do			5			1929	Kramer, Eddy, and Kohman (*413*).
	Klapps Liebling [Clapp Favorite]			3			1929	Scheunert (*632*).
	Pastorenbirne [Vicar of Winkfield]			3				
Stored	5 months, at 40° F			Same as fresh			1927	Craven and Kramer (*138*).
	For usual marketing period, Bosc	11	[44] *	<8			1934	Manville and Chuinard (*476*).
	For usual marketing period, D'Anjou.	14	[25] *	14				
	For usual marketing period, Winter Nelis.	14	[91] *	11				
	1 month beyond usual marketing period, Winter Nelis.	9		10			1933	Manville and Chuinard (*475*).
	2 months beyond usual marketing period, D'Anjou.	6		7				

Dried			137			169	1934	Douglass, Halloway, Williams, and Garrison (*174*).
Pecan (*Hicoria pecan*):		360					1932	Levine (*447*).
	Burkett	160					1933	Fraps and Treichler (*234*).
	Texas Prolific [Sovereign]	200						
	Van Deman		[100]*				1925	Salmon and Livingston (*625*).
Stored	8 months in shell	50 percent fresh					1933	Fraps and Treichler (*234*).
Pecan oil					0		1932	Heller and Heston (*296*).
Pepino (melon pear) (*Solanum muricatum*).				33			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
Pepper (*Capsicum annuum*):	Green, sweet	650					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	do	943	11*	94			1927	Quinn, Burtis, and Milner (*579*).
	Red, pimiento	5,560					1933	Ascham (*18*).
	Red or yellow, ripe			Much > unripe green.			1934	Banga and Szent-Györgyi (*33*).
Dried	Green, sweet	2,000–4,000					1933	Fraps and Treichler (*234*).
	do	5,000					1933	Fraps and Treichler (*232*).
	Red, pimiento	Slightly > 25,000					1933	Ascham (*17*).
	Red, chili	8,980		0			1935	Rutherford (*617*).
	Red or yellow	>50,000					1933	Aseham (*18*).
Dried and stored	19 months, green, sweet	80 percent fresh dried					1933	Fraps and Treichler (*232*).
Pepper juice	Hungarian paprika			200–400			1933	Svirbely and Szent-Györgyi (*681*).
Persimmon (*Diospyros* spp.).	Chinese			[3–4]			1923	Embrey (*207*).
	do			[3]			1928	Hsü (*343*).
	Japanese, Tanenashi		[0]*				1930	Tilt, Hubbell, and Inman (*696*).
Pigeonpea (*Cajanus* spp.).						200	1932	Axtmayer and Silva (*25*).
	Gandules	300					1933	Axtmayer and Cook (*24*).
	C. indicus	[133]	333*				1928	Miller (*495*).
Pigeonpea plant meal.	Entire plant dried	[294]	333*				1928	Do.
Pineapple (*Ananas sativus*).		>20					1924	Miller (*492*).
				[30]			1925	Miller (*493*).
	Smooth Cayenne, pulp	100 (Int.)	25 (Int.)			23	1936	Miller, Bazore, and Robbins (*498*).
Pineapple juice				40			1921	Delf (*163*).
				16			1931	Von Hahn (*263*).
				20			1936	Miller, Bazore, and Robbins (*498*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Plantain (baking banana) (*Musa paradisiaca*).						47	1932	Axtmayer and Silva (*25*).
		1,110					1927	Cook (*117*).
			[15]*				1923	Cook and Quinn (*119*).
			2 (Int.)			0	1934	Ghosh and Guha (*238*).
Plum (*Prunus* spp.)			40 (Int.)				1935	Baker and Wright (*31*).
	Common and prune, Germany			10			1931	Von Hahn (*263*).
	Greengage			<16				
	Small red-blue, and large blue			<5			1929	Scheunert (*632*).
Pohas (*Physalis peruviana*):		4,000 (Int.)	50 (Int.)	50		50	1936	Miller, Bazore, and Robbins (*498*).
Pomegranate (*Punica granatum*):	Red fruited			0			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
Pomelo	See Grapefruit.							
Pork		0					1933	Fraps and Treichler (*234*).
			[350–370]			[>100]	(5)	North Dakota Agricultural Experiment Station (Latzke).
	Fresh ham		7–8×beef				1933	Kemmerer and Steenbock (*387*).
	Young pig, 30 pound		<Hog					
Frozen and stored	9 years, 2° to 15° F		Same as fresh				1923	Wright (*759*).
Dried			2,000			500	(5)	North Dakota Agricultural Experiment Station (Latzke).
Pork fat	Perinephritic	0.5–0.6×butter					1920	Drummond and Coward (*178*).
	Subcutaneous	0.1×butter						
Potato (*Solanum tuberosum*):			40 (Int.) 6				1935	Baker and Wright (*31*).
				11–16			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	White, immature			>Mature			(5)	Idaho Agricultural Experiment Station (Woods).
	do			[>33]			1929	Scheunert (*632*).
	White, mature			7			1921	Bezssonov (*52*).
	do					31	1931	Day (*159*).
	do		[44]				1933	Plimmer, Raymond, and Lowndes (*565*).
	do		[25–50]			[15–30]	1931	Roscoe (*602*).
	do			[10–20]			1922	Wisconsin Agricultural Experiment Station (*751*).

	White, mature, Bliss Triumph			[20]			1930	Richardson, Douglass, and Mayfield (*592*).
	do			Slightly >20			(5)	Wyoming Agricultural Experiment Station (Thiessen).
	White, mature, Netted Gem			[<10]			1930	Richardson, Douglass, and Mayfield (*592*).
	White, mature		40 (Int.)			[105]	1934	Ghosh and Guha (*238*).
	White, mature, boiled					25	1933	Idaho Agricultural Experiment Station (Woods). (*349*).
	White, mature, steamed	40					(5)	United States Department of Agriculture, Bureau of Home Economics (Munsell).
Stored	White, mature, 6 months, cool damp, or warm dry.		Same as fresh	Same as fresh			1932	Richardson and Mayfield (*593*).
	White, mature, 6 months, Bliss Triumph.			50 percent fresh			(5)	Wyoming Agricultural Experiment Station (Thiessen).
	White, mature, 6 to 8 months, Bliss Triumph.			<Fresh			1932	Wyoming Agricultural Experiment Station (*325*).
Stored and sprouted.	White, mature			[>33]			1929	Scheunert (*632*).
Frozen				Same as fresh			1934	Murri, Onokhova, Kudrjavtzeva, and Gutzevich (*541*).
	Followed by slow thawing			40 percent fresh				
Frozen and stored	10° C			0				
Dried	In vacuum after boiling with closed vapor.			10–16 percent fresh			1934	Shivrina and Onokhova (*652*).
Potato juice				0–trace			1921	Bezssonov (*52*).
	From early variety of potato			100 (Int.)			1933	Pelc and Podzimková (*557*).
	From late variety of potato stored 6 months.			5 (Int.)				
Prune (*Prunus domestica*):								
Fresh				Slightly <10			1931	Von Hahn (*263*).
Frozen	Agen	2,000					1930	Morgan and Field (*514*).
	do			6–8			1931	Morgan, Field, and Nichols (*516*).
Dried			90 (Int.)				1935	Baker and Wright (*31*).
		1,000					(5)	Columbia University (Munsell) (See Rice and Munsell, 1931.) (*591*).
				[0]			1918	Hess and Unger (*309*).
	Unsulphured, dehydrated, lye dipped.	1,765					1930	Morgan and Field (*514*).
	do			0			1931	Morgan, Field, and Nichols (*516*).
	Unsulphured, sun-dried	900–1,000 (Int.)	80–100	0		266	(5)	University of California (Morgan).
	Unsulphured, sun-dried, commercial.	1,765					1930	Morgan and Field (*514*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Prune—Continued.								
Dried	Unsulphured, sun-dried, commercial.			0			1931	Morgan, Field, and Nichols (*516*).
	Sulphured, dehydrated, lye dipped.	2,470					1930	Morgan and Field (*514*).
	do			20			1931	Morgan, Field, and Nichols (*516*).
	Sulphured, sun-dried	2,470					1930	Morgan and Field (*514*).
	do			11			1931	Morgan, Field, and Nichols (*516*).
Pumpkin (*Cucurbita pepo*).				10			1931	Von Hahn (*264*).
				3			1933	Ivanowa (*352*).
						[40]	1935	Lo (*452*).
Quince (*Cydonia oblonga*).				Slightly>10			1931	Von Hahn (*263*).
Radish (*Raphanus sativus*).			60 (Int.)				1935	Baker and Wright (*31*).
				7–20			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
				50			1931	Von Hahn (*264*).
			[21–26] *				1924	Morgan (*510*).
	Black, without peel			20			1931	Von Hahn (*264*).
Radish juice	Chinese winter turnip, strained			[5-10]			1928	Tso (*703*).
Raisin			75 (Int.)				1935	Baker and Wright (*31*).
		0					(5)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
	Muscat and Sultanina (Thompson Seedless).	0		0			1923	Dutcher and Outhouse (*189*).
	Sultanina (Thompson Seedless), sun-dried.	0	67	0		50	1935	Morgan, Kimmel, Field, and Nichols (*520*).
	Sultanina (Thompson Seedless), soda-dipped, sun-dried.	25 (Int.)	106	0		50		
	Sultanina (Thompson Seedless), soda-dipped, sulphured, sun-dried.	33 (Int.)		0		50		
	do		0				(3)	University of California (Morgan).
	Sultanina (Thompson Seedless), soda-dipped, dehydrated.	178 (Int.)	67	0		50	1935	Morgan, Kimmel, Field, and Nichols (*520*).
	Sultanina (Thompson Seedless), soda-dipped, sulphured, dehydrated.	178 (Int.)	0	0		50		

Raisin oil		0					1933	Fraps and Treichler (*234*).
		0					1923	Dutcher and Outhouse (*189*).
Raspberry (*Rubus* spp).				12			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
				[20]			1929	Scheunert (*632*).
Raspberry juice				50			1931	Von Hahn (*263*).
Red pepper	See Pepper.							
Redtop (*Agrostis alba*):		30,800±1,000 [5]					1935	Woods, Atkeson, Wellhousen, and Johnson (*757*).
Fresh		20,000±1,500						
Rhubarb (*Rheum rhaponticum*).			0 (Int.)				1935	Baker and Wright (*31*).
				11			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
				25–50			1935	Fellers (*217*).
		Trace					1929	Scheunert (*632*).
Rice (*Oryza sativa*)	Unpolished or brown		[110]				1931	Plimmer, Raymond, and Lowndes (*563*).
	do		80–100 (Int.)					
	Unpolished or brown, washed		50–60 (Int.)					
	Slightly polished		50–80 (Int.)					
	Slightly polished, washed		25–40 (Int.)				1933	Van Veen (*707*).
	Highly polished		20–40 (Int.)					
	Highly polished, washed		<20 (Int.)					
Stored	Hulled, 1 year in straw bags		92 percent fresh					
	Hulled, 2 years in straw bags		82 percent fresh					
	Hulled, 3 years in straw bags		56 percent fresh				1932	Kondo and Okamura (*410*).
	Hulled, 4 years in straw bags		23 percent fresh					
	Hulled, sun-dried moisture 11 to 13 percent, 26 to 28 years, airtight storage.		Slightly <fresh					
Germinated				[13]			1930	Matsuoka (*481*).
Rice bran	Sample A		760 (Int.)				1935	Baker and Wright (*31*).
	Sample B		560 (Int.)					
	Without hulls		2,000			200	(6)	Hawaii Agricultural Experiment Station (Miller).
Rice polishings			500–670			50–100	1933	Munsell and DeVaney (*534*).
Roe	Cod	[2,000–4,000]					1922	Zilva and Drummond (*767*).
	do		140				1933	Plimmer, Raymond, and Lowndes (*565*).
	Herring, soft		60 (Int.) [6]				1935	Baker and Wright (*31*).
Romaine	See Lettuce.							

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Rutabaga (*Brassica campestris*).				25			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
				33			1931	Von Hahn (*264*).
				[100]			1929	Scheunert (*632*).
				[33]			1922	Wisconsin Agricultural Experiment Station (*751*).
	White	0					1919	Steenbock and Gross (*667*).
Rutabaga juice				40			1918	Chick and Rhodes (*103*).
Stored				40			1925	Delf (*166*).
	1 year 3 months			<20				
	1 year 5 months			<10				
Rye (*Secale cereale*)				0			1928	Kucera (*419*).
			110				1931	Plimmer, Raymond, and Lowndes (*563*).
Rye germ			750 (Int.)				1935	Baker and Wright (*31*).
				[0]			1927	Scheunert (*630*).
Salmon	Canned:							
		30					(8)	Columbia University (Rice). (See Rice and Munsell, 1931.) (*591*).
						80	(8)	U. S. Department of Agriculture, Bureau of Home Economics (Munsell.)
	Red:							
	Brand G	400 (Int.)			800 (Int.)			
	Brand H	250 (Int.)						
	Chinook:							
	Brand I	>400 (Int.)			210 (Int.)			
	Brand J	800 (Int.)			260 (Int.)			
	Brand K				390 (Int.)			
	Pink:						1935	DeVaney and Putney (*169*).
	Brand C	100 (Int.)			760 (Int.)			
	Brand D	100 (Int.)			620 (Int.)			
	Brand E				710 (Int.)			
	Brand F				400 (Int.)			
	Calico, chum:							
	Brand A	30 (Int.)			260 (Int.)			
	Brand B	25 (Int.)			190 (Int.)			

Salmon oil	Commercial oils	0.3×cod-liver oil			0.5×cod-liver oil		1930	Nelson and Manning (*544*).
	Commercial oils, 5 tested for vitamin A, 3 for vitamin D.	[6,500–55,000]			0.5×—1.0×cod-liver oil.		1931	Tolle and Nelson (*698*).
	From trimmings				0.2×cod-liver oil		1927	Bills (*54*).
	From red salmon:							
	Chinook	◇cod-liver oil			⅓ cod-liver oil		1932	Eliot, Nelson, Souther, and Cary (*203*).
	do				2×cod-liver oil		1932	Mitchell and Coley (*504*).
	Chinook, from canned offal	[29,400]			do			
	Chinook, from canned salmon	[2,350]			◇Medicinal cod-liver oil.		1931	Tolle and Nelson (*698*).
	Chinook, body oil	[1,600]					1931	Truesdail and Boynton (*701*).
	Sockeye	◇cod-liver oil			2× cod-liver oil		1932	Eliot, Nelson, Souther, and Cary (*203*).
	do				do		1932	Mitchell and Coley (*504*).
	Sockeye, from canned offal	[24,600]			do		1931	Tolle and Nelson (*698*).
	Sockeye, from canned salmon	Small amount			do			
	Sockeye, body oil	[1,300]					1931	Truesdail and Boynton (*701*).
	From medium red salmon:							
	Coho or Silver, from canned offal.	[15,400]			◇Cod-liver oil		1931	Tolle and Nelson (*698*).
	Coho or Silver, from canned salmon.	0			do			
	Coho or Silver, body oil	[320]					1931	Truesdail and Boynton (*701*).
	From pink salmon:							
					2× cod-liver oil		1932	Mitchell and Coley (*504*).
	Humpback	0.5×cod-liver oil			do		1932	Eliot, Nelson, Souther, and Cary (*203*).
	From canned offal	[14,800]			do		1931	Tolle and Nelson (*698*).
	Humpback, from canned salmon.	[0]			do			
	Humpback, body oil	[<3]			do		1931	Truesdail and Boynton (*701*).
	From calico salmon:							
	Chum, from canned offal	Trace			{50 percent>cod-liver oil.		1931	Tolle and Nelson (*698*).
	Chum, from canned salmon	[0]			◇Cod-liver oil			
	Chum, body oil	0–trace					1931	Truesdail and Boynton (*701*).
Salmon-liver oil	5 species	5–20×cod-liver oil			2–3×cod-liver oil		1934	Lee and Tolle (*444*).
	Salmo salar	7.5×cod-liver oil					1933	Lovern, Edisbury, and Morton (*454*).
Salmon-egg oil	5 species				40–100 percent cod-liver oil.		1934	Lee and Tolle (*444*).
Sardine	Tinned		30 (Int.)				1935	Baker and Wright (*31*).
Sardine oil	See Fish oil.							
Sauerkraut	See Cabbage, fermented.							

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Seal fat (blubber)	From adult seal				0.03×cod-liver oil		1927	Bills (*54*).
	From newborn seals				[0]			
	Subcutaneous				0		1932	Matzko and Vital (*484*).
Sesame seed (*Sesamum orientale*).		25					(8)	Puerto Rico School of Tropical Medicine (Cook).
		[0]					1922	Drummond and Zilva (*182*).
Sesame-seed oil		0					1924	Delf (*164*).
		0					1920	Drummond and Coward (*178*).
		0					1933	Fraps and Treichler (*254*).
					[0]		1922	McCollum, Simmonds, Becker, and Shipley (*459*).
Shadblow (*Amelanchier* spp.).				40			1934	Jarussowa (*356*).
Shrimp oil					◇Cod-liver oil		1930	Brooks, Abernethy, and Vilbrandt (*84*).
		[0]					1922	Hjort (*329*).
Soursop juice (*Annona muricata*).			15 (Int.)	20			1936	Miller, Bazore, and Robbins (*498*).
Soybean (*Soja max*): Dried			[140]				1929	Plimmer, Raymond, and Lowndes (*562*).
	Yellow		770			900	1932	Wan (*712*).
	Yellow, Mammoth		400				(5)	University of Tennessee (Mauldin).
Spinach (*Spinacia oleracea*):			70 (Int.)				1935	Baker and Wright (*31*).
					0–trace		1926	Chick and Roscoe (*104*).
						150	(5)	Columbia University (Booher and Harris).
		4,750					(5)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*.)
				88			(5)	Columbia University (Quinn). (See Rice and Munsell, 1931.) (*591*.)
						146	(8)	Columbia University (Douglass).
		1,500–8,800					(8)	Columbia University (Gates).

				16			1931	Von Hahn (*264*).
				14–20			1929	Hessler and Craig (*320*).
			[50–65]*				1927	Hessler and Rogers (*322*).
			60*				1928	Rogers (*599*).
					Trace		1927	Roscoe (*600*).
			[>56]			[>48]	1930	Roscoe (*601*).
				Slightly<100			1931	Wasson (*716*).
				Varies with fertilizer treatment.			1933	Von Hahn and Görbing (*266*).
		28,000					(8)	Columbia University (Rice and Bessey).
	Market			[66–83]			1933	Bessey and King (*47*).
	do			86			1925	Eddy, Kohman, and Carlsson (*199*).
	Winter					100	1931	Day (*159*).
	Bloomsdale		100	30–50			1931	Hessler, Johnson, and Walch (*321*).
	Princess Juliana	6,670	38*					
	Virginia Savoy	7,140	40*	Slightly<100			1932	Kifer and Munsell (*392*).
	Viroflay	6,250	42*	do				
Frozen			80				(5)	University of California (Morgan and Lackey).
Dried			590					
Spinach, New Zealand (*Tetragonia expansa*).		6,666	[>36]*				1929	McLaughlin (*463*).
Squash (*Cucurbita* spp.):		2,000					(8)	Puerto Rico School of Tropical Medicine (Cook).
	C. maxima		10 (Int.)			[6]	1934	Ghosh and Guha (*238*).
Dried	Buttercup [*C. pepo*]	1,000	300–350			300–350	(8)	North Dakota Agricultural Experiment Station (Latzke).
Dried and stored	do		300–350			300–350		
Strawberry (*Fragaria* spp.):				100			1931	Von Hahn (*263*).
				26–43			1928	Kohman, Eddy, and Halliday (*405*).
	Howard Supreme and Klondike			50			1933	Fellers and Mack (*223*).
	Saxon			70				
	Wood			<18			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	Other varieties			35 or less				
Frozen				Same as fresh			1933	Fellers and Mack (*223*).
Suet	See Beef fat.							
Sugarcane (*Saccharum officinarum*).			0			0	(8)	United States Department of Agriculture, Bureau of Home Economics (Munsell).
Sugarcane juice				[0]			1921	Delf (*163*).
		0	0	0			1929	Miller (*496*).
		Trace	0–trace		0		1930	Nelson and Jones (*543*).

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Sugarcane sirup			0				1930	Nelson and Jones (*543*).
Swede	See Rutabaga.							
Sweetclover (*Melilotus alba*).	White blossom, fresh	20,000					1932	Woods, Shaw, Atkeson, and Johnson (*758*).
	White blossom, sweet, first year, fresh.	50,000±3,000 [5]					1935	Woods, Atkeson, Slater, Arndt, and Johnson (*756*).
	do	41,300±2,700						
	White blossom, sweet, second year, fresh.	24,200±1,900 [5]						
	do	13,800±1,400						
Sweetpotato (*Ipomoea batatas*):						40	(6)	Columbia University (Booher and Williams).
				18			1934	Bukin, Povolotzkaya, and Onokhova (*87*).
				8			1921	Delf (*163*).
			12 (Int.)			[30]	1934	Ghosh and Guha (*238*).
	Yellow	2,000					1933	Fraps and Treichler (*233*).
	Yellow Jersey, deep color, immediately after harvesting.	<1,000					1935	MacLeod, Armstrong, Heap, and Tolbert (*466*).
	Nancy Hall	830					1932	Hessler and Cole (*318*).
	do		67			33	(6)	Missouri Agricultural Experiment Station (Hessler and Cole).
	do	3,000	70				1932	MacLeod, Talbert, and Toole (*468*).
	Porto Rico	5,000					1933	Fraps and Treichler (*234*).
	do			10–20			(6)	University of Georgia (Lowry).
	Porto Rico, very deep color, immediately after harvesting.	2,000					1935	MacLeod, Armstrong, Heap, and Tolbert (*466*).
	Prolific, unfertilized	3,300					1932	Swanson, Nelson, and Haber (*682*).
	Prolific, manure fertilized	6,600						
	Prolific, fertilized or unfertilized soil.	[5,500]					1933	Swanson, Nelson, and Haber (*683*).
Stored				Same as fresh			(6)	Georgia Experiment Station (Newton).
	2 months or more, 50° F. to 60° F.:							
	Nancy Hall, deep color	3,000					1935	MacLeod, Armstrong, Heap, and Tolbert (*466*).
	Porto Rico, very deep color	6,500						
	Southern Queen, light color	400						
	Triumph, light color	200						
	Yellow Jersey, deep color	4,000						

Dried	In air, Porto Rico	200–300					1933	Fraps and Treichler (*234*).
	In vacuum, Porto Rico	5,000						
Sweetpotato juice				20–25			1921	Delf (*163*).
Sweetpotato peelings:								
Dried	Yellow	200					1933	Fraps and Treichler (*234*).
Tamarind (*Tamarindus indica*).			100 (Int.)				1936	Miller, Bazore, and Robbins (*498*).
Tangerine	See Orange.							
Tea (*Thea sinensis*)	Black			<4			1928	Mattill and Pratt (*483*).
	Green, pan fired, 2-percent infusion.			6–10				
	Green, basket fired, 2-percent infusion.			<5				
	Green, 2-percent infusion			0			1929	Mitchell (*506*).
	Green, 2-percent infusion			0			1929	Munsell and Kifer (*536*).
	do			0			1930	Munsell and Miller (*538*).
Timothy (*Phleum pratense* L.).		22,000±1,300 [5]					1935	Woods, Atkeson, Wellhousen, and Johnson (*757*).
		16,300±500						
Tomato (*Lycopersicum esculentum*).	Immature			<Mature			1930	Clow and Marlatt (*112*).
	do	<Ripe	<Ripe	<Ripe			1930	Jones and Nelson (*368*).
	do	Same as "mature" green.	Same as "mature" green.	<"Mature" green				
	"Mature" green, full grown	<Ripe	Same as ripe	<Ripe			1929	House, Nelson, and Haber (*340*).
	do			do			1930	Clow and Marlatt (*112*).
	do	<Vine ripe	<Vine ripe	do			1930	Jones and Nelson (*368*).
	do	◇Immature and artificial ripe.	◇Immature	>Immature				
	do	50 percent ripe	Slightly <ripe	75 percent ripe			1930	Kohman, Eddy, and Zall (*406*).
	Ripe		40 (Int.)				1935	Baker and Wright (*31*).
	do	500					(6)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
	do			33–50			1935	Fellers (*217*).
	do			20			1931	Von Hahn (*264*).
	do		[55]				1931	Plimmer, Raymond, and Lowndes (*564*).
	do		[20–40]			[12]	1931	Roscoe (*603*).
	Bonny Best, field ripened			25			1929	House, Nelson, and Haber (*340*).

See footnotes at end of table .

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Tomato—Contd.	English			40–67			1924	Delf (*165*).
	South African			25				
	Field			[33]			1930	Clow and Marlatt (*112*).
	Picked green and spontaneously ripened at room temperature.			◇Vine ripe				
	Picked green and spontaneously ripened at room temperature, Bonny Best.	◇Vine ripe	Slightly <vine ripe	Slightly <vine ripe			1929	House, Nelson, and Haber (*340*).
	Picked green and spontaneously ripened at room temperature.	[1,300]	[33]*	[>20]			1930	Kohman, Eddy, and Zall (*406*).
	Ethylene ripened			◇Vine ripe			1930	Clow and Marlatt (*112*).
	Ethylene ripened, Bonny Best	◇Vine ripe	Slightly <vine ripe	Slightly <vine ripe			1929	House, Nelson, and Haber (*340*).
	Vine ripened, greenhouse		◇Field ripe*				1930	House, Nelson, and Haber (*341*).
	Vine ripened, greenhouse, ripeness ordinarily used.			Slightly <field ripe			1929	Wisconsin Agricultural Experiment Station (Clow, Stevenson, and Marlatt). (*108*).
	Vine ripened, greenhouse, completely ripe.			◇Field ripe				
	Diploid and tetraploid respectively			230–240 (Int.)			1933	Key (*388*).
Frozen	"Mature" green, full grown	<Ripe						
	Ripe, picked green, spontaneously ripened at room temperature.	◇Vine ripe					1928	Morgan and Smith (*524*).
	Ethylene ripened	do						
	Ethylene ripened, Red Globe	1,000–2,000					1928 [10]	Do.
	Greenhouse, Red Globe	666–2,000					1928 [10]	Do.
	Vine ripened, Red Globe	1,330–3,300					1933	Smith and Morgan (*656*).
	Ripened on vine in field, Red Marglobe.	Slightly <400 (Int.)						
	Vine ripened in field, Red Gulf State Market.	Slightly >800 (Int.)					(8)	United States Department of Agriculture, Bureau of Home Economics (Munsell).
	Vine ripened in field, Golden Perfection.	Slightly <100 (Int.)						
	Vine ripened in field, white, variety unknown.	<18 (Int.)						
	White, Clark Albino	Trace					1933 [10]	Smith and Morgan (*656*).
Stored	Shipped in			[<5]			1925	Wisconsin Agricultural Experiment Station (Parsons). (*753*).
Tomato Juice				[33–50]			1933	Bessey and King (*47*).
				25			1934	Daggs and Eaton (*147*).
		538					1925	Sherman and Munsell (*644*).
	From tomatoes purchased on open market.			220 (Int.)			1933	Key (*388*).
	Home canned, field ripened, 13 samples.					15–28	1935	Poe and Gambill (*569*).

	Commercially canned, 18 samples						18–28	1935	Poe and Gambill (*668*).
	Commercially canned			<Orange juice				1935	Somers and Sweetman (*660*).
	Commercially canned in tin cans:								
	Brand no. 1			33					
	Brand no. 2			Much <16–25					
	Brand no. 3			25				1935	Fellers, Clague, and Isham (*218*).
	Brand no. 4			20					
	Commercially canned in glass bottles, brand no. 5			25					
	Cocktail, commercial 3 brands			<Canned juice				1935	Somers and Sweetman (*660*).
	Laboratory canned, Marglobe			Much <25–30					
	Laboratory canned, Marglobe, homogenized			Much <25					
	Laboratory canned, Stone			Very much <25					
	Laboratory canned, Stone, homogenized.			Very much <20					
	Laboratory canned, Marglobe, concentrated one-half volume in open kettle.			33				1935	Fellers, Clague, and Isham (*218*).
	Laboratory canned, unknown variety, concentrated one-half volume in open kettle.			30					
	Sieved from canned whole tomatoes, commercial.			30					
	Sieved from canned whole tomatoes, laboratory preparation.			30					
	Filtered, Bonny Best and Red Globe.		[11–13]*					(8)	Cornell University (Spohn, Becker et al.).
	Filtered, Golden Queen		Slightly <11–13*						
	Filtered, commercially canned						<Unfiltered	1935	Poe and Gambill (*668*).
	Filtered, home canned, field ripened, 13 samples.						do	1935	Poe and Gambill (*669*).
	Filtered, serum			30				1931	Spohn (*662*).
	From tetraploid strain			1,000 (Int.)				1933	Sansome and Zilva (*628*).
	From diploid strain			500 (Int.)					
Tuna oil	See Fish oils.								
Turnip (*Brassica rapa*)			40 (Int.)[6]					1935	Baker and Wright (*31*).
				14				(8)	Columbia University (Sherman).
							50	1931	Day (*159*).
							[21]	1931	Roscoe (*602*).
			[<35]	33				1922	Wisconsin Agricultural Experiment Station (*751*).
				8–16				1934	Bukin, Povolotzkaya, and Onokhova (*87*).
	White	18					17–22	(8)	Columbia University (Bisbey)

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Turnip—Continued.	White	0		[50–100]			1929	Scheunert (*632*).
	Yellow	16					(3)	Columbia University (Munsell). (See Rice and Munsell, 1931.) (*591*).
Turnip greens		7,000 (Int.)					(3)	Columbia University.
	Purple Top Globe	[5,300]				300	1931	Day (*159*).
	Purple Top Globe	[5,300]	[57]*	[57]			1928	Burton (*90*).
	Purple Top Globe	7,100	[>50]	330			1931	Newton (*548*).
Dried		3,300					1933	Fraps and Treichler (*234*).
Veal						100–150	1931	Day (*158*).
Veal fat					[0]		1927	Bills (*54*).
Vegetable marrow (*Cucurbita pepo*).	Young green			8			1921	Delf (*163*).
	Mature			3				
Vegetable marrow juice.	Young green			20			1921	Do.
	Mature			7				
Walnut (*Juglans* spp.).			150 (Int.)				1935	Baker and Wright (*31*).
Waterchestnut (*Trapa bispinosa*).	[Singhara-nut]		18 (Int.)			0	1934	Ghosh and Guha (*238*).
Watercress (*Radicula nasturtium-aquaticum*).			60 (Int.)				1935	Baker and Wright (*31*).
		[>1,000]		100			1928	Coward and Eggleton (*131*).
			[55]				1931	Plimmer, Raymond, and Lowndes (*564*).
			[66]			[60–120]	1930	Roscoe (*601*).
Watermelon (*Citrullus vulgaris*).				9			1934	Jarussowa (*356*).
	Tom Watson	89	14–20	14	0	14	1930	Munsell (*530*).
Whale oil	Blubber				[0]		1927	Bills (*54*).
	Blubber, sperm	<Cod-liver oil					1924	Delf (*164*).
	Head, sperm	<Blubber or meat oil						
	Meat, sperm	<Good butter						

Wheat (*Triticum aestivum*)[1]	Immature		2 × mature				1928	Wierzchowski (*728*).
	Immature, medium stage of development.			>Mature and germinated.			1933	Von Hahn (*265*).
	Mature:							
			170				1928	Chase (*97*).
		20					1933	Fraps and Treichler (*234*).
				0			1912	Holst and Frölich (*335*).
			Slightly >164				1931	Hetler, Meyer, and Hussemann (*323*).
		0					(2)	Columbia University (Munsell).
			150			80	1933	Munsell and DeVaney (*534*).
			[110]				1931	Plimmer, Raymond, and Lowndes (*563*).
						[48–75]	1931	Roscoe (*603*).
	3 samples		230–340 (Int.)				1935	Baker and Wright (*31*).
	Sample no. 1		125 (Int.)			100	1935	Morgan and Hunt (*519*).
	Sample no. 2		189 (Int.)					
	Sample no. 3		142 (Int.)					
	Sample no. 1 with 10 percent added germ.		184 (Int.)					
	Sample no. 1 with 20 percent added germ.		242 (Int.)			124		
Germinated			4 × mature				1928	Wierzchowski (*728*).
Wheat bran			130 (Int.)[6]				1935	Baker and Wright (*31*).
			⅓ wheat germ				1927	Cramer and Mottram (*136*).
			2.5 × wheat				1932	Kansas Agricultural Experiment Station (Kramer) (*94*).
			[220]				1931	Plimmer, Raymond, and Lowndes (*563*).
	Raw		300				1932	Rose, Vahlteich, Funnell, and MacLeod (*606*).
	Commercial preparation		150					
Wheat germ			1,100 (Int.)				1933	Coward, Burn, Ling, and Morgan (*128*).
			[1,720]				1932	Miller (*497*).
			450–1,000			180 380	1933	Munsell and DeVaney (*534*).
			[680]				1931	Plimmer, Raymond, and Lowndes (*563*).
			[2,500]			[150 300]	1931	Roscoe (*603*).
				[0]			1927	Scheunert (*630*).
		300					(3)	United States Department of Agriculture, Food and Drug Administration (Nelson).
	Sample no. 1		758 (Int.)			404	1935	Morgan and Hunt (*519*).
	Sample no. 2		940 (Int.)					
	Sample no. 3		860 (Int.)					
	Crude, 5 samples, tested separately		590–1,875 (Int.)				1935	Baker and Wright (*31*).
	Proprietary, 4 samples, tested separately		1,425–1,500 (Int.)					

See footnotes at end of table.

TABLE 1.—*Quantitative data on the vitamin A, B, C, D, and G content of foods*—Continued

Food	Description given by investigator	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G	Year reported	Investigator
Wheat middlings			0.5 × wheat germ				1927	Cramer and Mottram (*136*).
			4 × wheat				1932	Kansas Agricultural Experiment Station (Kramer) (*94*).
			[410]				1931	Plimmer, Raymond, and Lowndes (*563*).
Wheat shorts	Gray	5–30					1933	Fraps and Treichler (*234*).
Yam (*Dioscorea* spp.)	*D. alata*, white	Slightly <25					1932	Axtmayer and Cook (*23*).
	D. cayennensis, yellow	Slightly >100						
Yautia (*Xanthosoma* spp.).	White	38	[26]*				1927	Cook (*117*).
	do	25					(8)	Puerto Rico School of Tropical Medicine (Cook).
	do		[30]*				1928	Cook and Quinn (*119*).
	Yellow	50	[56]*				1927	Cook (*117*).
	do	100					(8)	Puerto Rico School of Tropical Medicine (Cook).
	do		[50]*				1928	Cook and Quinn (*119*).
Yeast:								
Dried	Bakers'		>1,000				(8)	Hawaii Agricultural Experiment Station (Miller).
	do	0–trace					1931	Honeywell, Dutcher, and Ely (*338*).
	do		1,110			1,670	1933	Munsell and DeVaney (*534*).
	do		⅓ brewers'				1931	Plimmer, Raymond, and Lowndes (*563*).
	Bakers' powdered commercial product.		260			885	1930	Quinn, Whalen, and Hartley (*580*).
	Bakers' moist yeast dried in laboratory.		450–475			950		
	Bakers' pure dehydrated commercial product.		860			1,425		
	Brewers'					[1,500–3,000]	1929	Aykroyd and Roscoe (*27*).
	do		>Bakers'			>Bakers'	1932	Drummond and Whitmarsh (*181*).
	do		10 × wheat				1931	Plimmer, Raymond, and Lowndes (*563*).
	do		1,260 (Int.)			1,593	1935	Morgan and Hunt (*519*).
	do		[5,000]			[3,000]	1931	Roscoe (*603*).
	Brewers', 2 samples, tested separately.		600–2,300 (Int.)				1935	Baker and Wright (*31*).
	Brewers', bottom		4,080			1,140	1930	Quinn, Whalen, and Hartley (*580*).
	Brewers' distillery top		7,140			1,715		

[1] Unless qualified by Int. (International Unit), all numerical values for vitamins A, B, C, and G are Sherman units per 100 g, and values for vitamin D are A. D. M. A. units (pp. 10–11) per 100 g. Bracketed values indicate that the units were calculated from data that necessitated estimations. Many data reported in the literature in terms of the untreated food or some material of well-known vitamin value have also been included because they possess certain quantitative significance.

[2] No attempt has been made to bring foreign varietal nomenclature in harmony with American nomenclature. In some cases where it appeared feasible from the available data, there has been an attempt to more adequately classify the food materials than was done by the investigator. Any classification supplied by this laboratory is indicated by enclosure in brackets.

[3] Vitamin B_1 values unless marked with asterisk (*) indicate vitamin B complex. A vitamin B-complex value determined by the rat-growth method is also an indication of vitamin G potency. The value may not be a maximum one in either case.

[4] Vitamin G values have recently been shown to be essentially measures of growth-promoting flavin (*63*, *100*, *206*, *261*). See also footnote 3.

[5] Calculated on the basis of a gain of 12 g in 4 weeks instead of 25 g in 8 weeks.

[6] Author indicates that the probable error for the dose used is over 50 percent.

[7] Assumed by investigators.

[8] Unpublished.

[9] Dependent on method and metal of apparatus.

[10] Private communication in addition to reference cited.

TABLE 2.—*Ascorbic acid content of foods*

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator [1]	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Alfalfa (*Medicago* spp.):						
Fresh	*M. denticulata*, Willd., lucerne	90	91		1935	Chi and Read (*99*).
Alfalfa leaves (*Medicago sativa*):						
Fresh	Lucerne	320–380			1935	Levy and Fox (*448*).
	do	450				
	Lucerne, sample 1	320–330				
	Sample 2	250–310				
	Sample 3	320				
	Sample 4	240–310				
	Sample 5	230–250				
	Sample 1 after 24 hours standing without water	360–380				
	Sample 2 after 24 hours standing in water	220–230				
	Sample 2 after 72 hours standing in water	190–210				
	Sample 3 after boiling in water 20 minutes	299				
	Flowering stage	220–310				
Dried	Sample 4, fresh, calculated to dry basis	800–1,030				
	Sample 5, fresh, calculated to dry basis	920–1,000				
Alfalfa stalks	Fibrous	70				
	Small	180				
Alfalfa leaves and small stalks.		270–310				
Alfalfa shoots		300–380				
Alfalfa meal	Commercial, 2 samples	0				
	Commercial, green, with little stalk	57				
	Prepared from bale of market alfalfa	79				
	Leaves of sample 4 scalded 30 seconds, air-dried without direct sunlight 4 days.	380–440				
	Odd sample prepared as above	150				
	Dried in air oven, 6 minutes, 250° C	>700				
	Sample 5, dried 2 days over sulphuric acid in vacuo.	740–830				
Stored	11 weeks, original contained 4 milligrams ascorbic acid per gram.	270				
	6 months, original contained 7.4 milligrams ascorbic acid per gram.	300				

Almond (*Amygdalus* spp.)	Sweet	0		0	1935	Tauber and Kleiner (*688*).
Apple (*Malus* spp.)		0.1			1935	Ahmad (*7*).
	Ripe	2.1			1935	Ranganathan (*583*).
	M. prunifolia rinki, Chinese, green	0.8	28	39 [2]	1935	Chi and Read (*99*).
	Kashmir	2.5			1935	Ahmad (*7*).
Apple flesh (*Malus sylvestris*).	Blenheim Orange	3.1			1933	Birch, Harris, and Ray (*61*).
	Bramley's Seedling	16				
	Cox's Orange Pippin	1.6				
	King Edward VII	1.7				
	McIntosh	4		<5	1935	Tauber and Kleiner (*688*).
	Newton Wonder	5.3			1933	Birch, Harris, and Ray (*61*).
Apple peel	From ripe fruit	2.6			1935	Ranganathan (*583*).
	Blenheim Orange	33			1933	Birch, Harris, and Ray (*61*).
	Bramley's Seedling	77				
	Cox's Orange Pippin	9				
	King Edward VII	12				
	Newton Wonder	24				
Apricot (*Prunus* spp.)	*P. mume*, unripe, Japanese	1.8	16		1935	Chi and Read (*99*).
	P armeniaca	0.8				
	Preserved	0–trace			1935	Ranganathan (*583*).
Artichoke, globe (*Cynara scolymus*).		Trace			1935	Do.
Asparagus (*Asparagus officinalis*):		12			1935	McHenry and Graham (*462*).
Cooked	Reduced ascorbic acid	8.2				
Balsam-pear (*Momordica charantia*):	Ucheche	33	46		1935	Ghosh and Guha (*239*).
	Karela	51			1935	Ahmad (*7*).
	do	53			1935	Ahmad (*6*).
	Karela, cut up or shredded, after 10 minutes	46.3				
	Karela, cut up or shredded, after 20 minutes	43.1				
	Karela, cut up or shredded, after 2 hours	17.8				
Stored	Karela, 3 days, room temperature	10				
Bamboo leaves (*Phyllostachys* spp.).	*P. bambusoides*	32	79		1935	Chi and Read (*99*).
Bamboo shoots	Hairy variety	11	26			
	Kashing	3.4	22			
	Flat variety	3	9.9			

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine [1]	Other methods		
		Mg.	*Mg.*	*Mg.*		
Banana (*Musa sapientum*).		15			1933	Birch, Harris, and Ray (*61*).
	Pulp, green	2.1			1935	Ahmad (*7*).
	Pulp, red	1.4				
	Pulp, yellow	<1				
Bastard apple	See Custard-apple.					
Bean:	Broadbean [*Vicia faba*]	12.2			1935	Ranganathan (*583*).
	Cluster [*Cyamopsis psoralioides*]	49.4				
	Double, seeds only	22.4				
	French, from bazaar [*Phascolus vulgaris*]	13.8				
	French, pink variety [*P. vulgaris*]		27.7			
	French, tender [*P. vulgaris*]	40.9				
	French, green [*P. vulgaris*]	2.6			1935	Ahmad (*7*).
	French, green [*V. faba*]	4.7	23		1935	Chi and Read (*99*).
	Hyacinth [*P. vulgaris*] [*Dolichos lablab*]	8.2	48			
	Hyacinth [*P. vulgaris*] outer shell	7.6	11			
	Hyacinth [*P. vulgaris*] 10 varieties	9–24			Unpub.	New York Agricultural Experiment Station (Tressler).
	Hyacinth [*P. vulgaris*] average of above	18				
	Snap, green [*P. vulgaris*]	12	14		1933	Bessey and King (*47*).
	Snap, reduced ascorbic acid [*P. vulgaris*]	1.4			1935	McHenry and Graham (*462*).
	Snap, reduced ascorbic acid, plus reversibly oxidized ascorbic acid.	4				
Cooked	Snap, reduced ascorbic acid [*P. vulgaris*]	2.1 [3]				
Canned	Snap, green [*P. vulgaris*]	4	4		1933	Bessey and King (*47*).
Dried		1.25			1935	Ahmad (*7*).
	Gram [Mung], brown	2.5				
	Gram [Mung], white, Kabuli	3				
	Mung, brown	2.3				
	Mung, green	3				
	Mung, black	2.7				
	[*P. mungo*], Kanchamug, water content 8.4 percent.	4	12		1935	Ghosh and Guha (*239*).
Sprouted		14.2			1935	Ahmad (*7*).
	Gram [Mung], brown	7.8				
	Gram [Mung], white, Kabuli	7.3				
	Mung, black	10.5				
	Mung, brown	11.7				
	Mung, green	23				

	Mung[urd?], *P. mungo*	2.2	15		1935	Chi and Read (*99*).
	P. mungo, Kanchamug, water content 65.4 percent.	4	13		1935	Ghosh and Guha (*239*).
Beer	After precipitation of tannins, pigments, etc., with mercuric acetate.			0	1935	Tauber and Kleiner (*689*).
Beet (*Beta vulgaris*)	Reduced ascorbic acid	2.7			1935	McHenry and Graham (*462*).
	After removal of interfering substances and pigments.	10		6	1935	Tauber and Kleiner (*688*).
	Roots		88		1935	Ranganathan (*583*).
Cooked	Reduced ascorbic acid	6.2 [3]			1935	McHenry and Graham (*462*).
Beet greens (*Beta vulgaris*).			84.5		1935	Ranganathan (*583*).
	After removal of interfering substances and pigments.	36		40	1935	Tauber and Kleiner (*688*).
Bel (*Aegle marmelos*)	Wood apple	7.6			1935	Ahmad (*7*).
	do	18.0	33		1935	Ghosh and Guha (*239*).
Betel leaves (*Piper betle*)	[Climbing species of pepper grown in India]	4.8–52			1935	Ranganathan (*583*).
Bilimbi	See Carambola.					
Bilimbi juice	See Carambola juice.					
Brain	Pig, 1 year old	18			1933	Bessey and King (*47*).
Broccoli (*Brassica oleracea botrytis*):	Reduced ascorbic acid	32				
	Reduced ascorbic acid, plus reversibly oxidized ascorbic acid.	68			1935	McHenry and Graham (*462*).
Cooked	Reduced ascorbic acid	22				
Brussels sprouts (*Brassica oleracea gemmifera*).		71.8			1935	Ranganathan (*583*).
Cabbage (*Brassica* spp.)		13.3			1935	Ahmad (*6*).
		100			1933	Birch, Harris, and Ray (*61*).
	From bazaar	51.2			1935	Ranganathan (*583*).
	Market	22		29	1935	Tauber and Kleiner (*688*).
	New	40	42		1933	Bessey and King (*47*).
	4 varieties	22–38			Unpub.	New York Agricultural Experiment Station (Tressler).
	B. chinensis, small	40	42			
	B. oleracea, small	33	44		1935	Chi and Read (*99*).
	B. oleracea, var. *rubra*, red		81	81 [2]		
	Reduced ascorbic acid	15				
	Reduced ascorbic acid, plus reversibly oxidized ascorbic acid.	22			1935	McHenry and Graham (*462*).
	After removal of interfering substances and pigments.	24		32	1935	Tauber and Kleiner (*688*).
	Leaves	40.5			1935	Ahmad (*7*).

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Cabbage—Continued	Inner leaves	132.6			1935	Ranganathan (*583*).
	Outer leaves	125.8				
	Small sprouts	50	51		1935	Chi and Read (*99*).
Cooked	Reduced ascorbic acid	12			1935	McHenry and Graham (*462*).
	Boiled 10 minutes	40.5			1935	Ahmad (*6*).
	Boiled 15 minutes	29.2				
	Boiled 30 minutes	22.3				
	Boiled 1 hour	14.8				
	Boiled 1½ hours	5				
	Boiled 2 hours	1.56				
Cabbage juice		42.7 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Cantaloup	See Muskmelon.					
Carambola (*Averrhoa carambola*).	Bilimbi	23	11		1935	Ghosh and Guha (*239*).
Carambola juice	Bilimbi, ripe fruit	15.9			1935	Ranganathan (*583*).
Carrot (*Daucus carota*)		6.6			1935	Ahmad (*7*).
		2.8			1933	Birch, Harris, and Ray (*61*).
		2.5			1935	Ranganathan (*583*).
		2		<1	1935	Tauber and Kleiner (*688*).
		2	7.3		1935	Chi and Read (*99*).
	Reduced ascorbic acid	1.2			1935	McHenry and Graham (*462*).
	Reduced ascorbic acid plus reversibly oxidized ascorbic acid.	2.1				
Cooked	Reduced ascorbic acid	2.6 [3]				
Carrot juice		4 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Cauliflower (*Brassica oleracea botrytis*):		5.9			1935	Ahmad (*7*).
		65.8			1935	Ranganathan (*583*).
		42	53		1935	Chi and Read (*99*).
	Reduced ascorbic acid	19			1935	McHenry and Graham (*462*).
Cooked	do	31 [3]				
Celery (*Apium graveolens*)		2.9			1935	Ahmad (*7*).
		3	9		1935	Chi and Read (*99*).
	Stalks	5.7			1935	Ranganathan (*583*).

Celery juice		0.9 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Celery leaves		62.4			1935	Ranganathan (*583*).
Cherry (*Prunus* spp.)	(*P. pauciflora*)		14		1935	Chi and Read (*99*).
Chicken	Muscle, from 3-months-old bird	4			1933	Bessey and King (*47*).
Chicken gizzard		1.7	28		1935	Chi and Read (*99*).
Chicken heart	From 3-months-old bird	8			1933	Bessey and King (*47*).
Chicken liver		22	103		1935	Chi and Read (*99*).
	From 3-months-old bird	28			1933	Bessey and King (*47*).
Chickpea (*Cicer arietinum*):						
Sprouted	Gram, Bengal	14.2			1935	Ranganathan (*583*).
Citron (*Citrus medica*)		19	20		1935	Ghosh and Guha (*239*).
Clam	*Cytherea*, yellow	9.3	16		1935	Chi and Read (*99*).
	Mactra, small white	17	19			
	Solenidae, razor shell	77	29			
Coconut (*Cocos nucifera*).	Edible portion	0.8			1935	Ranganathan (*583*).
	Green, pulp	3.4			1935	Ahmad (*7*).
Coconut water		2			1935	Ranganathan (*583*).
	From fresh green coconut	1.66			1935	Ahmad (*7*).
	From ripe coconut	5				
Coriander (*Coriandrum sativum*).	Leaves	17	29		1935	Chi and Read (*99*).
	Leaves, tender	135.2			1935	Ranganathan (*583*).
	Seeds	0				
Corn (*Zea mays*):						
Fresh	Indian, young cobs	8.05			1935	Ahmad (*7*).
	Maize, fairly tender	3.5			1935	Ranganathan (*583*).
Cooked	Reduced ascorbic acid	7.6			1935	McHenry and Graham (*462*).
	Reduced ascorbic acid	5.1				
Cowpea (*Vigna sinensis*)		6.7 [4]	25	14 [2]	1935	Chi and Read (*99*).
Cucumber (*Cucumis sativus*).		6.9			1935	Ahmad (*7*).
		1.2			1935	Guerrant, Rasmussen, and Dutcher (*254*).
		1.5	10.4	7 [2]	1935	Chi and Read (*99*).
		4	53		1935	Ghosh and Guha (*239*).
	Reduced ascorbic acid	0.80			1935	McHenry and Graham (*462*).
	Reduced ascorbic acid plus reversibly oxidized ascorbic acid.	2				
Cumin (*Cuminum cyminum*).	[Seasoning ingredient in curry powder]	3			1935	Ranganathan (*583*).

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Custard-apple (*Annona reticulata*)		1.3			1935	Ranganathan (*583*).
		15	39		1935	Ghosh and Guha (*239*).
Dandelion greens (*Taraxacum officinale*)		8–10		8–10	1935	Kleiner and Tauber (*398*).
		42	48		1935	Chi and Read (*99*).
Date (*Phoenix dactylifera*)	Preserved	0–trace			1935	Ranganathan (*583*).
Drumstick (horseradish tree) (*Moringa pterygosperma*)		119.6			1935	Ranganathan (*583*).
Duck liver		13	38		1935	Chi and Read (*99*).
Eggplant (*Solanum melongena*)		<2		<5	1935	Tauber and Kleiner (*688*).
	Brinjal	22.5			1935	Ahmad (*7*).
		7.1	7.4		1935	Chi and Read (*99*).
	Begoon, blue variety	5	7.9		1935	Ghosh and Guha (*239*).
	Begoon, white variety	5	11.0			
Egg white, duck's		0.3	3.8		1935	Chi and Read (*99*).
Egg yolk, duck's		1.3	11			
Egg yolk, hen's		0			1933	Birch, Harris, and Ray (*61*).
Fig	Preserved	0–trace			1935	Ranganathan (*583*).
Garlic (*Allium* spp.):						
Fresh		13.2			1935	Do.
	A. Scordoprasm, young plant	29	37		1935	Chi and Read (*99*).
	A. Scordoprasm, full-grown plant	20	26			
Stored		5.2			1935	Ahmad (*7*).
Ginger (*Zingiber officinale*)		20	16		1935	Chi and Read (*99*).
	Root	6			1935	Ahmad (*7*).
Gourd	Bitter	88.4			1935	Ranganathan (*583*).
	Momordica charantia, bitter, Canton	22	30		1935	Chi and Read (*99*).
	Small white, local	2.7	7.9	28 [2]		
	Benincasa cerifera, white, Canton	4.2	9			
	Lagenaria leucantha, varlonga	0.9	8.2	10 [2]		

	[*Lagenaria vulgaris*], Snake	0–trace			1935	Ranganathan (*583*).
	Luffa cylindrica), Loofah	3.9	9.2	11 [2]	1935	Chi and Read (*99*).
	[*Luffa cylindrica*], Patôl	13.1			1935	Ahmad (*7*).
Gourd leaves	*Lagenaria vulgaris*, Lau shak	5	12		1935	Ghosh and Guha (*239*).
Grape (*Vitis* spp.)		<1			1935	Ahmad (*7*).
		≦3			1933	Birch, Harris, and Ray (*61*).
				(6)	1931	Gerasimov and Vinogradova (*237*).
Grape juice	From very ripe and old fruit	2.5			1935	Ranganathan (*583*).
Grapefruit (*Citrus grandis*).		53	53		1933	Bessey and King (*47*).
Grapefruit juice		31.2			1935	Ahmad (*7*).
		65			1933	Birch, Harris, and Ray (*61*).
		59				
		26.6 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
		40			1933	Harris and Ray (*276*).
				62	1935	Tauber and Kleiner (*689*).
	From very ripe and old fruit	2.1			1935	Ranganathan (*583*).
	United States, bought on Shanghai market	52 [4]	52 [4]		1935	Chi and Read (*99*).
Canned		41 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Grass	Green, tender, and fresh	75.3			1935	Do.
	Lawn	73			1933	Bessey and King (*47*).
Guava (*Psidium guajava*)		104	147		1935	Ghosh and Guha (*239*).
	Country, ripe	299				
	Hill variety, ripe and fresh	11			1935	Ranganathan (*583*).
	Hill variety, tender and fresh	19.1				
	Pulp	90			1935	Ahmad (*7*).
Heart	Pig, 1 year old	4			1933	Bessey and King (*47*).
Hip berry		459			1935	Giroud, Ratsimamanga, and Leblond (*243*).
Dried		1,200–1,400			1934	Lund, Spur, and Fridericia (*458*).
Horseradish (*Radicula armoracia*).		160			1933	Birch, Harris, and Ray (*61*).
	Cochlearia armoracia	18	22	52 [2]	1935	Chi and Read (*99*).
Jambolan-plum (*Eugenia jambolano*).		16	25		1935	Ghosh and Guha (*239*).
Kale (*Brassica oleracea acephala*).		34	49		1935	Chi and Read (*99*).

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Kan-kun (*Ipomoea reptans*).		11	15		1935	Chi and Read (*99*).
		137.1			1935	Ranganathan (*583*).
	Kalmi-shak	6	7		1935	Ghosh and Guha (*239*).
Kidney	Pig	14	53		1935	Chi and Read (*99*).
Kohlrabi (*Brassica* spp.)	*B. caulo-rapa*	69	72		1935	Do.
	B. oleracea gongylodes, Knol-khol	84.5			1935	Ranganathan (*583*).
		10.7			1935	Do.
Leek (*Allium* spp.) [Siberia].	*A. odorum*, whole plant	33	34		1935	Chi and Read (*99*).
Lemon (*Citrus limonia*)	6 samples	42–65			1935	McHenry (*461*).
Lemon Juice		38.5			1935	Ahmad (*7*).
			(5)		1933	Bennett and Tarbert (*46*).
		57	57		1933	Bessey and King (*47*).
		62			1933	Birch, Harris, and Ray (*61*).
		60				
			54 [4]		1933	Harris and Ray (*275*).
		62			1933	Harris and Ray (*276*).
		68		70	1935	Tauber and Kleiner (*688*).
				61	1935	Tauber and Kleiner (*689*).
	13 samples	45.5 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
	(Albedo, flavedo, and peel from these same fruits also tested).	100			1934	Bacharach, Cook, and Smith (*29*).
	January to February, 9 samples		42–55 [4]		Unpub.	Washington State College (Batchelder)
	April, 8 samples		38–54 [4]			
	Fruit purchased on open market, first day:					
	Small fruit, sample no. 1	51.5 [4]				
	Large fruit, sample no. 2	40.7 [4]				
	Small fruit, sample no. 3	58.3 [4]				
	Very large fruit, sample no. 4	18.3 [4]				
	Medium large fruit, sample no. 5	38.0 [4]			1933	Harris and Ray (*277*).
	Large fruit, sample no. 6	44.0 [4]				
	Large fruit, sample no. 7	41.0 [4]				
	Sample no. 8	47.5 [4]				
	Sample no. 9	50.6 [4]				
	Average of preceding 9 samples	43.0 [4]				

	Fruit purchased on open market, second day:					
	Sample no. 10	55.6 [4]				
	Small and withered fruit, sample no. 11	68.4 [4]				
	Large and fresh fruit, sample no. 12	35.4 [4]				
	Small and withered fruit, sample no. 13	66.1 [4]				
	Very small and withered fruit, sample no. 14	69.4 [4]				
	Average of preceding 5 samples	59.0 [4]				
	Fruit purchased on open market, third day:					
	Sample no. 15	37.3 [4]				
	Sample no. 16	38.1 [4]			1933	Harris and Ray (*277*).
	Sample no. 17	66.9 [4]				
	Sample no. 18	33.9 [4]				
	Sample no. 19	47.2 [4]				
	Sample no. 20	34.2 [4]				
	Average of preceding 6 samples	43.0 [4]				
	Average of preceding 20 samples for all 3 days	47.0 [4]				
	Fruit purchased on open market, fourth day, composite sample of 10 lemons.	47.0 [4]				
	Messina variety, Nov. 29 to Dec. 13, 1933, average	39.0 [4]			1934	Lund, Spur, and Fridericia (*458*).
	Messina variety, Mar. 12 to Mar. 25, riper than above group, average.	56.0 [4]				
	Cape Colony, purchased December 1933, average.	54 [4]				
	Italy, purchased December 1933, average	66 [4]				
	Messina, Sicily, purchased December 1933, average.	68 [4]			1934	Bacharach, Cook, and Smith (*29*).
	Malaga, Spain, purchased December 1933, average.	68 [4]				
	15 samples, average	64 [4]				
	After removal of interfering substances and pigments.	63		65	1935	Tauber and Kleiner (*688*).
	Reduced ascorbic acid	52			1935	McHenry and Graham (*462*).
	Reduced ascorbic acid plus reversibly oxidized ascorbid acid.	52				
	From stored lemons, 4 weeks, open, laboratory:					
	Cape	57 [4]				
	Italian	54 [4]			1934	Bacharach, Cook, and Smith (*29*).
	Malaga	67 [4]				
	5 samples of 3 preceding types, average	59 [4]				
Canned		46		50	1935	Tauber and Kleiner (*688*).
Lemon albedo	(Juice, flavedo, and peel from these same fruits also tested).	46	51			
Lemon flavedo	(Juice, albedo, and peel from these same fruits also tested).	210	220		1934	Bacharach, Cook, and Smith (*29*).
Lemon peel	Whole (juice, albedo, and flavedo from these same fruits also tested).	100				
Lemon jelly		<1				

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Lentil:						
Dried	Masur	3			1935	Ahmad (7).
Sprouted		15				
Lettuce (*Lactuca sativa*)		0.5			1935	Do.
		14.9			1935	Ranganathan (*583*).
	Head	5	7		1933	Bessey and King (*47*).
		4.2	14		1935	Chi and Read (*99*).
	L. scariola, tops, Chinese species	1.2	7			
	Reduced ascorbic acid	0.30			1935	McHenry and Graham (*462*).
	Reduced ascorbic acid, plus reversibly oxidized ascorbic acid.	3.8				
Lichi or litchi	See Lychee.					
Lime Juice (*Citrus aurantifolia*).		16.8			1935	Ahmad (*7*).
		45.9			1935	Guerrant, Rasmussen, and Dutcher (*254*).
	From unripe, fresh fruit	68.1			1935	Ranganathan (*583*).
	From ripe fruit	39.6				
	From very ripe and old fruit	23.8				
	Bombay variety	58.8			1935	Ahmad (7).
	Sweet	31.2				
Lime peel	From unripe, fresh fruit	63.9			1935	Ranganathan (*583*).
	From ripe fruit	115.1				
	From very ripe and old fruit	120.6				
Liver	Calf	33			1933	Svirbely (*678*).
	Beef	68			1933	Birch, Harris, and Ray (*61*).
	do	31			1933	Svirbely (*678*).
	Ox	24	99		1935	Chi and Read (*99*).
	Pig	38			1933	Birch and Dann (*59*).
	do	29	98		1935	Chi and Read (*99*).
	do	12			1933	Svirbely (*678*).
	Pig, 1 year old	19			1933	Bessey and King (*47*).
	Sheep	45			1933	Birch and Dann (*59*).
	do	41	142		1935	Chi and Read (*99*).
	do	46			1933	Svirbely (*678*).

Loquat (*Eriobotrya japonica*).	Hangchow, red	2.2	10		1935	Chi and Read (*99*).
	Ripe	Trace			1935	Ranganathan (*583*).
Lotus root (*Nelumbo nucifera*).		2.7	17	11 [2]	1935	Chi and Read (*99*).
Lotus seed		20	51	30 [2]	1935	Do.
Lychee (*Litchi chinensis*)		48	79		1935	Ghosh and Guha (*239*).
		27	45		1935	Chi and Read (*99*).
	Bengal	48			1935	Ahmad (*7*).
	Mozaffapur	25				
Stored	0° C. for 35 days, Bengal	25				
Maize	See Corn.					
Malabar-plum (*Eugenia jambos*).	Rose-apples	6	12		1935	Ghosh and Guha (*239*).
Malabar-nightshade (*Basella cordifolia*).	Pooin shak	8	15		1935	Do.
Malayapple (*Eugenia malaccensis*).	Jamrool	4	7.9		1935	Do.
Mango (*Mangifera indica*)	Pulp	13			1935	Ahmad (*7*).
	Pulp, different graft from above	15.3				
	Green	3.2				
	Green, Bengali deshi variety, Kancha	5	9.7		1935	Ghosh and Guha (*239*).
	Ripe, Bengali deshi variety, Paka	2	4.4			
	Ripe, Fozli variety	34	44			
	Ripe, Langra variety	69	88			
	Green, very tender, pickled in salt	176.5			1935	Ranganathan (*583*).
	Dried, pickled in salt	2.6				
Mango juice	Green, Bengali deshi variety, Kancha	22 [4]	73 [4]		1935	Ghosh and Guha (*239*).
	Ripe, Bengali deshi variety, Paka	10 [4]	16 [4]			
Mangosteen	Edible portion	3.1			1935	Ranganathan (*583*).
	Outer skin from above fruit	0–trace				
Marmalade	Made from citrus fruits:					
	Commercial, very high peel content, 2 samples.	11–14			1934	Bacharach, Cook, and Smith (*29*).
	Commercial, high peel content, 6 samples	7–7.5	7			
	Commercial, medium peel content, 6 samples.	7–8.5	9.5–10.5			
	Commercial, low peel content, 2 samples	6–6.5				
	Home-made, medium peel content	1				

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Medlar (*Mespilus germanica*)		2			1935	Giroud, Ratsimamanga, and Leblond (*243*).
Milk, cow's, whole		1 [4]			1933	Bessey and King (*47*)
		1 [4]			1934	King and Waugh (*395*).
		1.9–2.5			1933	Birch, Harris, and Ray (*61*).
		0.4			1935	Ranganathan (*583*).
	June 28 to July 25, 13 samples, median	1.7 [4]			1935	Harris and Ray (*278*).
	Average of above 13 samples	1.8 [4]				
	Oct. 1 to Oct. 7, 18 samples, median	2 [4]				
	Average of above 18 samples	2 [4]				
	From cows on pasture	2.65 [4]			1936	Riddell, Whitnah, Hughes, and Lienhardt (*594*).
	From cows on dry ration, no silage	2.68 [4]				
	From cows on dry ration plus silage	2.58 [4]				
	From either pasture or stall-fed animals, Netherlands.			1.5–2.3 [4]	1934	Wijngaarden. (*See* Harris and Ray, 1935) (*278*).
Pasteurized	Grade B			0.7 [4]	1935	Tauber and Kleiner (*689*).
	By electrical conductivity, all aluminum equipment	1 [4]			1934	King and Waugh (*395*).
	By flash contact, all aluminum equipment	1 [4]				
	By vat process	0.4 [4]				
	Heated 30 minutes, 145° F	0.4 [4]			1933	Bessey and King (*47*).
Milk, human, whole	June 28 to July 25, 13 samples, median	6 [4]			1935	Harris and Ray (*278*).
	Average of above 13 samples	5.6 [4]				
Mint leaves (*Mentha* spp.)		0			1935	Ahmad (*7*).
Muskmelon (*Cucumis melo*)		1.5	14	5.9 [3]	1935	Chi and Read (*99*).
		3	5.3		1935	Ghosh and Guha (*239*).
Mustard (*Brassica* spp.)		0			1935	Ranganathan (*583*).
	B. cernua, leaves	81	102		1935	Chi and Read (*99*).
	B. cernua, stems	39	40			
	B. cernua, black, seeds	44	79			
Nightshade (*Solanum* spp.)	*S. nigrum*	11.3			1935	Ranganathan (*583*).
	S. pubescens	7.4				

Oatmeal	Ground	0			1933	Harris and Ray (*276*).
	Whole grain	11				
	Sussex, ground	0			1933	Birch, Harris, and Ray (*61*).
Oats:						
Sprouted	96-hour germination	20			1933	Harris and Ray (*276*).
	120-hour germination	42				
	7-day germination	15–17.5			1935	Bogart and Hughes (*66*).
	Germinated in dark	◇Sprouting in light				
	Germinated in dark, epicotyl	90 percent total				
	Germinated in dark, kernel	◇Root				
	Germinated in dark, root	◇Kernel				
Okra (*Hibiscus esculentus*).	Lady's finger	17			1935	Ahmad (*7*).
Onion (*Allium* spp.)		9		10	1935	Tauber and Kleiner (*688*).
	A. fistulosum, Chinese, whole plant	23	31		1935	Chi and Read (*99*).
	A. cepa, foreign	15	24			
	do		33.8		1935	Ranganathan (*583*).
	Young and fresh	10.5			1935	Ahmad (*7*).
	Reduced ascorbic acid	5.9			1935	McHenry and Graham (*462*).
	Reduced ascorbic acid plus reversibly oxidized ascorbic acid.	13				
Stored		Trace			1935	Ahmad (*7*).
Cooked	Reduced ascorbic acid	3.1			1935	McHenry and Graham (*462*).
Orange (*Citrus* spp.)		(5)			1933	Bennett and Tarbert (*46*).
		60	71		1933	Bessey and King (*47*).
	Unripe	45			1935	Giroud, Ratsimamanga, and Leblond (*243*).
	Ripe	50				
	Ripe, weight 58.85 g	51.5–54.3			1935	Ranganathan (*583*).
	C. aurantium, pulp	18	24		1935	Ghosh and Guha (*239*).
	Mandarin (tangerine), [*C. nobilis deliciosa*]:					
	Nagpur	31.5			1935	Ahmad (*7*).
	Golden, Chinese, sour, Peiping market, January and February, Fukien King Chii.	44	45		1934	Sah, Ma, and Hoo (*622*).
	Golden, Chinese, sweet, Peiping market, January and February, Kwangtung King Chii.	28	30			
Stored	16 hours, weight of orange 58.85 g	50.7			1935	Ranganathan (*583*).
	24 hours, 1.25 g water loss	61.6				
	48 hours, 2.29 g water loss	60.1				
	72 hours, 3.18 g water loss	57.2				
	96 hours, 3.88 g water loss	53.0				
	144 hours, 5.26 g water loss	60.8				
	216 hours, 6.91 g water loss	54.6				
	264 hours, 8.43 g water loss	56.4				
	312 hours, 10.04 g water loss	61.6				
	384 hours, 10.98 g water loss	47.8				

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Orange Juice		31.2			1935	Ahmad (*7*).
		50 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
			87 [4]		1933	Harris and Ray (*275*).
		60 [4]	<80 [4]			
			60–75 [4]		1933	Harris and Ray (*276*).
				47	1935	Tauber and Kleiner (*689*).
		50		54		
	Several varieties	48–75			1933	Birch, Harris, and Ray (*61*).
	Loose skin, unripe	70.5			1935	Ranganathan (*583*).
	Loose skin, ripe	62.7				
	Loose skin, very ripe	34.5				
	Tight skin	102.8				
	Brazilian, 8 samples	47.6–75.7 [4]			1933	Harris and Ray (*277*)
	South African, 6 samples	62.8–90.9 [4]				
	Average above 14 Brazilian and South African samples.	63 [4]				
	39 samples, extreme values	22–89 [4]			1934	Bacharach, Cook, and Smith (*29*).
	Seville, 5 samples	22–46				
	Sweet	72				
	Canton, Shanghai market	59–60 [4]	60 [4]		1935	Chi and Read (*99*).
	Chinese, Hsing Hwei Cheng	30 [4]	36.6 [4]		1934	Sah, Ma, Hoo, and Lei (*623*).
	do	9.8	11.3			
	Chinese, Kwan Cheng	72.4 [4]	77.3 [4]			
	do	18	19.2			
	Siamese, Shanghai market	31 [4]	39 [4]		1935	Chi and Read (*99*).
	California, sample no. 1, fresh, Shanghai market.	51 [4]	55 [4]			
	California, sample no. 2, fresh, Shanghai market.	72 [4]				
	California, sample no. 3, old stock, Shanghai market.	11 [4]	17 [4]			
	California, Chinese laboratory		52 [4]		1934	Sah, Ma, Hoo, and Lei (*623*).
	Swatow, Shanghai market	32–33 [4]	36 [4]		1935	Chi and Read (*99*).
	Wenchow, sample no. 1, Shanghai market	1–4 [4]	4 [4]			
	Wenchow, sample no. 2, Shanghai market	20 [4]	20 [4]			

	Sweet, Brazil, December 1933	40–58 [4]			1934	Bacharach, Cook, and Smith (*29*).
	Sweet, Palestine, Jaffa, December 1933	58 [4]				
	Sweet, South Africa, December 1933	57 [4]				
	Spain, Almeria, Sweet, December 1933	89 [4]				
	Sweet, Spain, Tabernas, December 1933	54 [4]				
	Sweet, seedless, Spain, Gandia, December 1933	62 [4]				
	Bitter, Spain, Seville, December 1933	43 [4]				
	do	33 [4]				
	Mandarin (tangerine) [*Citrus nobilis deliciosa*]:					
		15				
		20.8			1935	Guerrant, Rasmussen, and Dutcher (*254*).
				50	1935	Tauber and Kleiner (*689*).
	Chinese, Fu Chii	38.2 [4]	42 [4]		1934	Sah, Ma, Hoo, and Lei (*623*).
	do	11.2	12.3			
	Chinese, Hsiu Mi Chii	33.5 [4]	40.5 [4]			
	do	9.1	10.9			
	Chinese, Ta Mi Kan	18.4 [4]	22.3 [4]			
	do	5.1	6.2			
	Algeria, December 1933, mean value	75 [4]			1934	Bacharach, Cook, and Smith (*29*).
	Jamaica, January 1934, mean value	15 [4]				
	Spain, December 1933, mean value	33 [4]				
	All varieties, 9 samples, mean value	37 [4]				
	After removal of interfering substances and pigments.	59		60	1935	Tauber and Kleiner (*689*).
	Aerated 2 hours	79 percent fresh			1933	Harris and Ray (*276*).
	From stored oranges, 4 weeks open, laboratory:					
	Brazil	27 [4]			1934	Bacharach, Cook, and Smith (*29*).
	Palestine, Jaffa	52 [4]				
	South Africa	53 [4]				
	Spain, Almeria	71 [4]				
	Spain, Seville	37 [4]				
	Spain, Tabernas	51 [4]				
	Spanish tangerine	19 [4]				
Stored	Chinese, stored at 10° C.:					
	Hsing Hwei Cheng:					
	16 days	69 percent fresh	72 percent fresh		1934	Sah, Ma, and Hoo (*621*).
	33 days	58 percent fresh	63 percent fresh			
	44 days	39 percent fresh	43 percent fresh			
	51 days	4 percent fresh	43 percent fresh			
	66 days	do	40 percent fresh			
	Kwan Cheng:					
	16 days	81 percent fresh	78 percent fresh			
	33 days	76 percent fresh	76 percent fresh			
	44 days	74 percent fresh	70 percent fresh			
	51 days	67 percent fresh	do			
	66 days	66 percent fresh	65 percent fresh			
	Fu Chii, mandarin (tangerine):					
	16 days	45 percent fresh	47 percent fresh			
	33 days	27 percent fresh	28 percent fresh			
	44 days	12 percent fresh	24 percent fresh			

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
Orange juice—Contd.						
Stored	Chinese, stored at 10° C.—Continued.					
	Fu Chii, mandarin (tangerine)—Contd.	*Mg.*	*Mg.*	*Mg.*		
	51 days	10 percent fresh	22 percent fresh			
	66 days	7 percent fresh	20 percent fresh			
	Hsiu Mi Chii, mandarin (tangerine):					
	16 days	54 percent fresh	56 percent fresh			
	33 days	26 percent fresh	28 percent fresh			
	44 days	15 percent fresh	21 percent fresh			
	51 days	6 percent fresh	26 percent fresh		1934	Sah, Ma, and Hoo (*621*).
	66 days	do	23 percent fresh			
	Ta Mi Kan, mandarin (tangerine):					
	16 days	92 percent fresh	95 percent fresh			
	33 days	90 percent fresh	86 percent fresh			
	44 days	87 percent fresh	81 percent fresh			
	51 days	78 percent fresh	83 percent fresh			
	66 days	74 percent fresh	do			
	Exposed to air, room temperature, benzoate preservative:					
	Navel [Washington Navel], filtered:					
	2 days	36.6 [4]	41.3 [4]			
	4 days	24.4 [4]	33.4 [4]			
	9 days	7.3 [4]	11.2 [4]			
	Navel [Washington Navel], strained through cheesecloth but not filtered:					
	2 days	53.2 [4]	59.8 [4]			
	5 days	35.5 [4]	44.4 [4]			
	21 days	9.7 [4]	12.8 [4]			
	53 days	4.3 [4]	2.1 [4]		1934	Joslyn, Marsh, and Morgan (*373*).
Frozen and stored	−17°, 6 months, thawed, exposed to air, room temperature, benzoate preservative:					
	Valencia, filtered:					
	2 days	35.5 [4]	34.2 [4]			
	5 days	17.5 [4]	23.7 [4]			
	8 days	10.2 [4]	10.7 [4]			
	12 days	5.2 [4]	3.3 [4]			
	25 days	4.3 [4]	2.6 [4]			
	64 days	3 [4]	1.4 [4]			

Heated	On water bath, 1 hour	60 percent fresh			1933	Harris and Ray (*276*).
	On water bath, 2 hours	30 percent fresh				
	Boiled 2 hours	34 percent fresh				
Canned		29.4 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
		40.0		42.0	1935	Tauber and Kleiner (*688*).
Orange juice concentrate.	Commercial laboratory no. 1	254				
	Commercial laboratory no. 1. (Value calculated from fresh juice).	265				
	Commercial laboratory no. 2	247–255				
	Commercial laboratory no. 3	228				
Orange jelly	Commercial	1	3.5		1934	Bacharach, Cook, and Smith (*29*).
Orange albedo	Seville	72–77				
	Sweet	69	68			
Orange flavedo	Seville	180–220				
	Sweet	130	140			
Orange peel		1.2			1935	Ahmad (*7*).
	Tight skin	156				
	Loose skin, unripe	105.6			1935	Ranganathan (*583*).
	Loose skin, ripe	131.3				
	Loose skin, very ripe	108.8				
	Whole, Seville	96–190				
	do	86	89			
	Whole, sweet	101	102		1934	Bacharach, Cook, and Smith (*29*).
	Whole, tangerine	69				
Orange pip (seed)	Seville	1				
Palm (*Borassus flabellifer*)	Core of unripe fruit	4	7		1935	Ghosh and Guha (*239*).
Papaya (*Carica papaya*)		48.1			1935	Ahmad (*7*).
		45.5			1935	Ranganathan (*583*).
		19.0	32.0		1935	Ghosh and Guha (*239*).
Papaya juice	From ripe fruit	41.0			1935	Ranganathan (*583*).
Papaya peel	Outer skin from ripe fruit	71.0				
Parsley (*Petroselinum hortense*).		176.0	186		1933	Bessey and King (47).
		280.8			1935	Ranganathan (*583*).
	Greens	140.0		180.0	1935	Tauber and Kleiner (*688*).
	Roots	14		13		
Parsnip (*Pastinaca sativa*)	Roots	40.0		36.0	1935	Do.
	Reduced ascorbic acid	3.7				
	Reduced ascorbic acid plus reversibly oxidized ascorbic acid.	5.0			1935	McHenry and Graham (*462*).
Cooked	Reduced ascorbic acid	6.1 [3]				
Parsnip greens		216.0		210.0	1935	Tauber and Kleiner (*688*).

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Pea (*Pisum sativum*)		16.0	21		1933	Bessey and King (*47*).
		27.0		31.0	1935	Tauber and Kleiner (*688*).
	18 varieties	18-40			Unpublished	New York Agricultural Experiment Station (Tressler).
	Green	7.25			1935	Ahmad (*7*).
	do	24.0	36.0		1935	Chi and Read (*99*).
	Country, seeds only	4.8			1935	Ranganathan (*583*).
	English, seeds only	9.2				
	Green, after removal of interfering substances and pigments.	19.0		21.0	1935	Tauber and Kleiner (*688*).
	Reduced ascorbic acid	14.0			1935	McHenry and Graham (*462*).
Cooked		6.0			1933	Bessey and King (*47*).
	Reduced ascorbic acid	8.1			1935	McHenry and Graham (*462*).
Canned		5.0	8.0		1933	Bessey and King (*47*).
		13.0		14.0	1935	Tauber and Kleiner (*688*).
Dried		2.7			1935	Ahmad (*7*).
	Before germination	0			1933	Harris and Ray (*276*).
	Soaked 24 hours, not germinated	8				
		9.1			1935	Ahmad (*7*).
Germinated	After 48 hour soaking	69			1933	Harris and Ray (*276*).
	After 72 hour soaking	82				
	After 96 hour soaking	86				
	After 12 hour soaking	0				
	After 48 hours	23.0				
	After 60 hours	43.0				
	After 90 hours	50.0				
	After 115 hours	50.0				
	After 140 hours	48.0				
	After 170 hours	49.0				
	After 12 days	49.0				
	After 7 days' cultivation on 10-percent gelatin solution, plus:				1934	Ray (*585*).
	No addition to gelatin solution	4.9–5.0				
	Glucose	19.4–25.0				
	Fructose	26.4–30.0				
	Galactose	16.8–23.7				
	Mannose	54.0–69.1				
	Sucrose	27.5–32.0				
	Lactose	13.0				
	Maltose	20.8				

Germinated	Arabinose	0				
	Xylose	2.7–12.0?				
	Starch	6.1				
	Dextrin	7.8				
	Mannitol	3.9				
	Sorbitol	0				
	Inositol	5.4				
	Sodium pyruvate	0				
	Methyl glyoxal	0				
	Sodium glutamate	0				
	Glycerol	7.9				
	Sodium lactate	0				
	Glycero phosphate	0				
	Grown on gelatin media containing 5 percent fructose:				1934	Ray (*585*).
	3 days	29.3				
	5 days	28.2				
	7 days	26.4				
	9 days	23.5				
	11 days	15.0?				
	12 days	18.0				
	14 days	12.7				
	Grown 7 days on fructose:					
	1.0 percent	8.3				
	2.5 percent	15.5				
	5.0 percent	26.4				
	7.5 percent	26.3				
	10.5 percent	26.0				
Pea pod	Country	20.3			1935	Ranganathan (*583*).
	English	25.5				
Peach		1.0			1935	Ahmad (*7*).
		8.0			1935	Giroud, Ratsimamanga, and Leblond (*243*).
	Prunus persica	1.4	23.0		1935	Chi and Read (*99*).
Peach juice		1.8			1935	Guerrant, Rasmussen, and Dutcher (*254*).
	From imported peach	1.5			1933	Birch, Harris, and Ray (*61*).
Pear (*Pyrus* spp.)		1			1935	Ahmad (*7*).
		5			1935	Giroud, Ratsimamanga, and Leblond (*243*).
	Country, fresh	Trace			1935	Ranganathan (*583*).
	Peiping	2.7	8.6			
	P. Sinensis, Shantung	3.1	5.5			
	P. Sinensis, Tientsin	1.2	10.0		1935	Chi and Read (*99*).
Pear juice	*P. Communis*, Australian	0.8				

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Pepper (*Capsicum* spp.)		65	72		1935	Chi and Read (*99*).
	(*C. annuum*), Canton	14	22			
	(*C. indicum*) chillies, Bombai	4	7.9		1935	Ghosh and Guha (*239*).
	(*C. indicum*) chillies, Maldah	45	202.0			
	(*C. indicum*) chillies, Patna	10	30			
	Green	180	183		1933	Bessey and King (*47*).
	do	200		200	1935	Tauber and Kleiner (*688*).
	Green, sweet, January to May		100–200		1933	Baumann and Metzger (*45*).
	Green, long variety, chillies	78.9			1935	Ranganathan (*583*).
	Green, round and short, chillies	143				
	Green, large round and small conical, Chinese	0			1934	Sah and Chang (*620*).
	Red, ripe	230	230		1933	Bessey and King (*47*).
	Red, green	45.5			1935	Ahmad (*7*).
	Red, sweet	200		220	1935	Tauber and Kleiner (*688*).
	Red, sharp, after removal of interfering substances and pigments.	190		189		
	Pimiento, ripe	182			1935	Giroud, Ratsimamanga, and Leblond (*243*).
	Pimiento, unripe	173				
	Red, large hilly	55.6			1935	Ahmad (*7*).
	Red, local variety	34				
	Red, second local variety	11.7				
	Red, Hungarian, paprika	200			1933	Svirbely and Szent-Györgyi (*681*).
	Red (*C. annuum*), large round and small conical, Chinese, August.	240			1934	Sah and Chang (*620*).
	Hot, reduced ascorbic acid	167			1935	McHenry and Graham (*462*).
	Hot, plus reversibly oxidized ascorbic acid	160				
Dried	Chillies		51.2		1935	Ranganathan (*583*).
Pepper juice	Green	203 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Persimmon (*Diospyros* spp.)		6.1			1935	Ranganathan (*583*).
Persimmon peel	Outer skin from above fruit	0–trace				
Pigeon liver		5.3			1935	Guha and Ghosh (*256*).

Pineapple (*Ananas sativus*).		28.5			1935	Ahmad (7).
	Swatow	18	28		1935	Chi and Read (99).
	Bengali deshi variety	22	27		1935	Ghosh and Guha (239).
	Singapore	7	23			
		62.9			1935	Ranganathan (583).
Pineapple juice		30			1933	Birch, Harris, and Ray (61).
		31 [4]			1935	Guerrant, Rasmussen, and Dutcher (254).
		75.9			1935	Ranganathan (583).
Canned		7 [4]			1935	Guerrant, Rasmussen, and Dutcher (254).
		16		20	1935	Tauber and Kleiner (688).
	Malay	11	12		1935	Ghosh and Guha (239).
Plantain (baking banana) (*Musa paradisiaca*).	Unripe, used as a vegetable	23.9				
	Common variety	5.5				
	Hill variety, ripe	8.5			1935	Ranganathan (583).
	Red variety, ripe	Trace				
	Rajan variety, ripe	do				
	Rasthali variety, ripe	do				
Plantain peel	Unripe, used as a vegetable	0–trace				
	Common variety	do				
	Hill variety, ripe	do				
	Red variety, ripe	do			1935	Do.
	Rajan variety, ripe	do				
	Rasthali variety, ripe	do				
Plantain leaves	*Plantago major*	12	16		1935	Chi and Read (99).
Plum (*Prunus* spp.)	*P. communis*	1.1	45		1935	Do.
	(Alucha), yellow-orange	<0.5			1935	Ahmad (7).
	Greengage	<0.5				
Plum juice		3 [4]			1935	Guerrant, Rasmussen, and Dutcher (254).
Pomegranate (*Punica granatum*).		11	18		1935	Ghosh and Guha (239).
Pomegranate juice		15.6			1935	Ahmad (7).
Pomelo	See Grapefruit.					
Potato (*Solanum tuberosum*).		12.5			1935	Do.
		15			1933	Birch, Harris, and Ray (61).
	New	17	22		1933	Bessey and King (47).
	Old	8	16			
	Uncooked	17.3			1935	Ranganathan (583).
	Old, reduced ascorbic acid	1.5			1935	McHenry and Graham (462).

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Potato—Continued.						
Cooked	Boiled in hot water, with skin	17.1			1935	Ranganathan (*583*).
	Old, reduced ascorbic acid	4.1 [3]			1935	McHenry and Graham (*462*).
Potato juice		2.1 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Prawn	[*Palaemon serratus*, shrimplike crustacean]	1.2	24		1935	Chi and Read (*99*).
Prune		1			1935	Giroud, Ratsimamanga, and Leblond (*243*).
Pummelo (*Citrus maxima*).	Chakotra, pulp	56.8			1935	Ahmad (*7*).
Pummelo juice	Chakotra	71.4			1935	Do.
	Pumelo, Siam, bought on Shanghai market	81 [4]	74 [4]		1935	Chi and Read (*99*).
	do	74 [4]				
	do	40 [4]				
	do		56 [4]			
Pumpkin (*Cucurbita pepo*).		1.1			1935	Ahmad (*7*).
	Brown variety	2			1935	Ranganathan (*583*).
	White variety	0.9				
Pumpkin seed	Brown variety	0–trace			1935	Do.
	White variety	do				
Purslane (*Portulaca oleracea*).	Whole plant	8	13	18 [2]	1935	Chi and Read (*99*).
Rabbit	Muscle	4			1933	Bessey and King (*47*).
Rabbit heart	From rabbit 60 days old	10				
	From rabbit 1 year old	5				
Rabbit liver		40			1933	Birch and Dann (*59*).
		10		10	1935	Tauber and Kleiner (*688*).
	From rabbit 60 days old	20			1933	Bessey and King (*47*).
	From rabbit 1 year old	13				

	From rabbit on diet of oats and dried clover	11			1933	Svirbely (*678*).
	From rabbit on diet of oats only for 10 days	8				
Radish (*Raphanus sativus*)		20	34		1935	Chi and Read (*99*).
	Tender	15			1935	Ranganathan (*583*).
	Pink variety	16.9				
	Root	40			1935	Ahmad (*7*).
Radish leaves	Young	113.8			1935	Do.
Rape (*Brassica napus*)	Leaves	33	33		1935	Chi and Read (*99*).
	Stems	51	58			
Rhubarb (*Rheum* spp.)	[*R. rhaponticum*]	21	21		1933	Bessey and King (*47*).
	do	5.9			1933	Birch, Harris, and Ray (*61*).
	Stalks	36.7			1935	Ranganathan (*583*).
	R. officinale, stalks	11	16	10 [2]	1935	Chi and Read (*99*).
	2 varieties	13–16			Unpublished.	New York Agricultural Experiment Station (Tressler).
Rhubarb juice		27.8 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Sapodilla (*Achras sapota*)	Sapota	6	2.6		1935	Ghosh and Guha (*239*).
	Chico	2.5			1935	Ahmad (*7*).
Sauerkraut juice:						
Canned		8.2 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Shepherds-purse (*Capsella bursapastoris*)	Whole plant, full grown	40	54		1935	Chi and Read (*99*).
Shrimp		2.5	31		1935	Do.
Soybean (*Soja max*)	Leaves	33.3			1935	Ahmad (*7*).
	Glycine soja, pods	11	18		1935	Chi and Read (*99*).
Germinated	*Glycine soja*, sprouts	2.2	14		1935	Do.
Spinach (*Spinacia oleracea*):		31.5			1935	Ahmad (*7*).
		62	68		1933	Bessey and King (*47*)
		36.9–63.7			1935	Ranganathan (*583*).
		92		100	1935	Tauber and Kleiner (*688*).
		34	48		1935	Chi and Read (*99*).
	Palang-shak	6	7		1935	Ghosh and Guha (*239*).
	Market	40	53		1933	Bessey and King (*47*).
	Poorly manured garden	36.9				
	Farmyard manured garden	63.7			1935	Ranganathan (*583*).
	Before the rains	36.9				
	After the rains	53.3				

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Spinach—Continued	Collected during rainy weather, sample no. 2	53.3			1935	Ranganathan (*683*)
	Collected during sunny weather, sample no. 3	36.9				
	pH 5.99, sample no. 1	37.7				
	Reduced ascorbic acid	18			1935	McHenry and Graham (*462*).
	Reduced ascorbic acid, plus reversibly oxidized ascorbic acid.	22				
	After removal of interfering substances and pigments.	43		46	1935	Tauber and Kleiner (*688*).
	Grown on Ontario clay loam soil:					
	Leaves:					
	Hollandia	79			1936	Tressler, Mack, and King (*700*).
	Prickly Winter	78				
	Stems:					
	Hollandia	4				
	Prickly Winter	6				
	Leaves, grown on muck soil:					
	Eskimo	62				
	Old Dominion	56				
	Noble	55				
	Victoria	55				
	Viroflay	53				
	Broad Flanders	49				
	Long Standing Bloomsdale	49				
	Virginia Savoy	48				
	Prickly Winter	46				
	Hollandia	42				
	King of Denmark	40				
	Princess Juliana	38				
	Average of above	49				
	Leaves, grown on upland soil:					
	Eskimo	77				
	Old Dominion	70				
	Noble	79				
	Victoria	66				
	Viroflay	78				
	Broad Flanders	89				

	Long Standing Bloomsdale	74				
	Virginia Savoy	80				
	Prickly Winter	75				
	Hollandia	75				
	King of Denmark	64				
	Princess Juliana	53				
	Average of above	75				
	Leaves, too small for harvesting:					
	Hollandia	78			1936	Tressler, Mack, and King (*700*).
	Prickly Winter	72				
	Leaves, 4 days later than above, nearly full-grown:					
	Hollandia	75				
	Prickly Winter	75				
	Leaves, past optimum maturity, beginning to go to seed:					
	Hollandia	79				
	Prickly Winter	78				
	Stalks	29				
Stored	Sample no. 1:					
	24 hours, pH 6.20	23.7				
	48 hours, pH 6.30	16.4				
	72 hours, pH 6.39	13.7				
	96 hours, pH 6.46	10.7				
	144 hours, pH 6.64	6.5				
	168 hours, pH 7.02	3.8				
	192 hours, pH 7.10	3.3				
	216 hours, pH 7.24	2.1				
	Sample no. 2, collected during rainy weather:					
	Calculated on same moisture content as fresh:					
	24 hours	35.1				
	48 hours	30.2			1935	Ranganathan (*683*).
	72 hours	28.4				
	96 hours	23.4				
	120 hours	13.6				
	168 hours	10.7				
	192 hours	6.7				
	216 hours	3.3				
	Calculated on reduced moisture content:					
	24 hours	46.4				
	48 hours	41.7				
	72 hours	45.7				
	96 hours	7.7				
	120 hours	31.1				
	168 hours	39.0				
	192 hours	31.6				
	216 hours	29.5				

See footnotes at end of table.

119220°—37——9

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
Spinach—Continued.						
Stored	Sample no. 3, collected during sunny weather:					
	Calculated on same moisture content as fresh:	*Mg.*	*Mg.*	*Mg.*		
	24 hours	19.5				
	48 hours	8.9				
	72 hours	5.6				
	96 hours	4.1				
	120 hours	2.9				
	144 hours	2.6				
	168 hours	1.8				
	192 hours	1.8				
	Calculated on reduced moisture content:				1935	Ranganathan (*583*)
	24 hours	27.7				
	48 hours	12.2				
	72 hours	9.2				
	96 hours	8.2				
	120 hours	6.7				
	144 hours	7.1				
	168 hours	6.3				
	192 hours	7.6				
	1° to 3° C.:					
	Hollandia, fresh contained 79 mg ascorbic acid per 100 g:					
	3 days	76				
	7 days	64				
	17 days	49				
	Prickly Winter, fresh contained 78 mg ascorbic acid per 100 g:					
	3 days	76				
	7 days	72			1936	Tressler, Mack, and King (*700*).
	17 days	39				
	23° to 26° C.:					
	Hollandia, fresh contained 79 mg ascorbic acid per 100 g:					
	3 days	39				
	7 days	3				

	Prickly Winter, fresh contained 78 mg ascorbic acid per 100 g:					
	3 days	44			1936	Do.
	7 days	5				
Cooked	Reduced ascorbic acid	12.0			1935	McHenry and Graham (*462*).
Canned		5.0	8		1933	Bessey and King (*47*).
		18.0		22	1935	Tauber and Kleiner (*688*).
Squash (*Cucurbita maxima*):		2.5			1935	Ahmad (*7*).
	Kumra	5	11		1935	Ghosh and Guha (*239*).
	Canton, "pumpkin"	4.6	8.3		1935	Chi and Read (*99*).
	Hubbard, after precipitation of tannins, pigments, etc., with mercuric acetate.			1.5	1935	Tauber and Kleiner (*689*).
	Hubbard, reduced ascorbic acid	3.1			1935	McHenry and Graham (*462*).
Cooked	do	4.1 [3]				
Squash leaves	Kumra-shak	11	24		1935	Ghosh and Guha (*239*).
Strawberry (*Fragaria* spp.)	*F. elatior*	49	69		1935	Chi and Read (*99*).
Sugarcane juice (*Saccharum officinarum*).	Canton	0.4	1.3		1935	Do.
Tamarind		2.6			1935	Ranganathan (*583*).
Tangerine	See Orange, mandarin.					
Taro (*Colocasia esculenta*)	Small variety	Trace			1935	Do.
Tea (*Thea* spp.)	After precipitation of tannins, pigments, etc., with mercuric acetate.			22	1935	Tauber and Kleiner (*689*).
	T. sinensis, leaves	1.05	1.18		1935	Chi and Read (*99*).
Tomato (*Lycopersicum esculentum*):		18	30		1935	Do.
	4 samples	18–36			1935	McHenry (*461*).
	8 varieties	16–31			Unpub.	New York Agricultural Experiment Station (Tressler).
	Toronto market, average of several samples	27			1935	McHenry (*461*).
	Unripe	27			1935	Giroud, Ratsimamanga, and Leblond (*243*).
	Ripe	33				
	Ripe, whole fruit	32.2			1935	Ranganathan (*583*).
	Tender, whole fruit	31.3				
	Tree, yellow variety	0–trace				
	Reduced ascorbic acid	15			1935	McHenry and Graham (*462*).
	Reduced ascobic acid, plus reversibly oxidized ascorbic acid.	15				
Canned	Average of several samples	22			1935	McHenry (*461*).
	Strained for infant feeding, brand A, 8 samples	9.2–11.2				
	Strained for infant feeding, brand B, 8 samples	5.4–11.1				

See footnotes at end of table.

TABLE 2.—*Ascorbic acid content of foods*—Continued

[Values expressed as milligrams per 100 grams]

Food	Description given by investigator	Quantity of ascorbic acid			Year reported	Investigator
		Dye method	Iodine method	Other methods		
		Mg.	*Mg.*	*Mg.*		
Tomato juice		25.9			1935	Ahmad (7).
		23	27		1933	Bessey and King (*47*).
		18		24	1935	Tauber and Kleiner (*688*).
		15.7 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
	From ripe, whole fruit	32.2			1935	Ranganathan (*583*).
	From imported tomato	21			1933	Birch, Harris, and Ray (*61*).
	Average of several samples	19			1935	McHenry (*461*).
Canned		24.2 [4]			1935	Guerrant, Rasmussen, and Dutcher (*254*).
		23		24	1935	Tauber and Kleiner (*688*).
Turnip (*Brassica rapa*)		28			1935	Ahmad (7).
		43.4			1935	Ranganathan (*583*).
		20	40	33 [2]	1935	Chi and Read (*99*).
	After precipitation of tannins, pigments, etc., with mercuric acetate.	32		38	1935	Tauber and Kleiner (*688*).
	Reduced ascorbic acid	35			1935	McHenry and Graham (*462*).
Cooked	do	18.0				
Turnip juice		19.1			1935	Guerrant, Rasmussen, and Dutcher (*254*).
Turnip greens		110		120	1935	Tauber and Kleiner (*688*).
Vegetable marrow (*Cucurbita* spp.).		17.8			1935	Ahmad (7).
Waterchestnut (*Trapa bispinosa*).	Paniphal [Indian Singhara-nut]	15.0	18.0		1935	Ghosh and Guha (*239*).
Watercress (*Radicula nasturtium-aquaticum*).		54.0	76.0		1933	Bessey and King (*47*).
		67.0			1933	Birch, Harris, and Ray (*61*).
Watermelon (*Citrullus vulgaris*).		<1.0			1935	Ahmad (7).
		7.0	11		1935	Ghosh and Guha (*239*).
	Small	7.6	13	7.8 [2]	1935	Chi and Read (*99*).
Watermelon juice		6.2	8.2	6.5 [2]		

Waternut (*Scirpus tuberosus*).		3.2	13.0		1935	Do.
Wildrice, tops (*Zizania aquatica*).	Water bamboo	2.0	9		1935	Do.
Willow leaves (*Salix babylonica*).		125.0	194		1935	Do.
Wine				< grape	1931	Gerasimov and Vinogradova (*237*).
Yang mei (*Myrica rubra*).	Strawberry tree, fruit of	13	36		1935	Chi and Read (*99*).

[1] Descriptions in brackets have been supplied.
[2] After reduction with H_2S.
[3] Samples "Show an increased titration value after heating for a short period or after acid hydrolysis. The increase is believed to be due to the liberation of ascorbic acid from a compound which is soluble in water but insoluble in trichloroacetic acid."
[4] Milligrams per 100 cc.
[5] Only cubic centimeter of approximate N/1,000 dye per 1 cubic centimeter of juice is given.
[6] 75 percent tomato juice.

TABLE 3.—*A digest of quantitative values for the vitamin A, B, C, D, and G content of foods*

Food	Units [1] per 100 g of—				
	Vitamin A [2]	Vitamin B [3]	Vitamin C	Vitamin D	Vitamin G [4]
Alfalfa leaf meal (dried) [5]	12,000				
Almond		100			
Apple	80	25			20
Baldwin and Yellow Newton			25		
Northern Spy, Spitzenberg, and Stayman Winesap			10		
Delicious, Jonathan, and McIntosh			4		
Apricot	5,400		6		
Dried, commercial	7,000		20		
Artichoke:					
Globe	280		18		
Jerusalem		55			
Asparagus:					
Green	700		40		
Bleached	0		40		
Avocado	500		18		55
Banana	275	30	18		35
Powder	1,000	100	5		100
Barley	0	110	0		
Bean:					
Green, snap	1,000	40	25		25
Dried pinto		1,000			
Dried red kidney		250			[6]
Beef, lean	75	50			125
Beet	0		10		50
Beet tops					250
Blackberry	200		6		
Blueberry:					
Highbush			23		
Lowbush	25		6		
Broccoli:					
Entire plant			18		140
Flower	7,000	65			275
Flower and stem		35			
Leaf	30,000	65			275
Stem	1,500				75
Brussels sprouts	300		55		
Buckwheat		220			
Butter:					
Average	2,200			80	
Cows on dry feed	1,200			40	
Cows on pasture	3,500			150	
Cabbage, head:					
Young (partly green)	50	50	55		60
Mature (bleached)	0	50	55		40
Red			55		
Chinese	2,000	25	50		25
Cane sirup	0	0	0		0
Cantaloup	425	20	35		
Carrot:					
Young	3,000	50	7		50
Mature	5,500	50	7		50
Cauliflower	50		55		60
Celery, stalks:					
Green	1,500		10		
Bleached	15		10		
Chard	17,200				
Cheese:					
Cheddar	2,500				200
Cottage	80				
Cream	3,500				45
Parmesan	1,250				
Cherry			20		
Lambert	20				
Deacon and Bing	200				
Napoleon (Royal Ann) and Early Richmond	450				
Late Duke and Montmorency	800				

[1] Values for vitamins A, B, C, and G are given in Sherman units and for vitamin D in International Units.

[2] Value of 0 indicates that the food contains too little vitamin A to be of practical significance.

[3] Vitamin B differentiated from vitamin G unless marked with an asterisk (*) indicating that the value was determined before recognition of vitamin G. The figures marked with an asterisk may not be maximum values.

[4] Vitamin B values determined by the rat-growth method before recognition of vitamin G also indicate vitamin G potency. These figures are marked with an asterisk and, as in the case of vitamin B, may not indicate maximum potency.

[5] Included because of its rather extensive use in reinforced cereals and infants' foods.

[6] Trace.

TABLE 3.—*A digest of quantitative values for the vitamin A, B, C, D, and G content of foods*—Continued

Food	Units per 100 g of—				
	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G
Chestnut		110			
Chicken liver			30	55	
Chickpea, dried	50	*500			*500
Cider, fresh			(7)		
Clam	20			5	
Codfish	5				
Cod-liver oil [8]					
Collard	4,500	60	100		100
Corn, sweet			17		
Dried, white	0	130			
Dried, yellow	600	130			
Corn oil, refined	0			0	
Cottonseed flour	0	470			170
Cottonseed oil	0	*0		0	0
Cowpea, dried	250				140
Cranberry	20	0	25	0	0
Cream (20 percent)	750				
Cucumber	25		25		
Dandelion	25,000				
Date, commercial, cured	140	40	0	0	0
Dock, leaves	19,000				
Eggplant	50		7		
Eggs	1,000	50	0	15	110
Whites	0	0		0	80
Yolks	3,000	150		45	170
Elderberry			5		
Endive			20		
Escarole	20,000		10		95
Fig	40	35	4		50
Dried, commercial	36	33	0		40
Flour, patent (wheat)	0	5	0		
Gooseberry			50		
Grape	25	20	3		0
Grape juice, commercial	0	0	0		0
Grapefruit	0	20	52		40
Grapefruit juice	0		65		
Haddock	5				
Hazlenut		220			
Heart:					
Beef					300
Mutton		88			
Honey	0	0	0	0	0
Horseradish			200		
Kale	30,000	50			200
Kidney:					
Beef or veal					900
Mutton	825	88			
Kohlrabi		*25	110		*25
Lambsquarters	14,000				
Lard	5				
Leek		55	25		
Lemon juice	0		65		
Lettuce:					
Green	4,000	35	8		50
Bleached, Iceberg	125	35	8		25
Liver:					
Beef		75		45	1,000
Calf	7,300			10	900
Lamb				17	
Pig	8,000			44	
Milk, whole:					
Average market	165	20	0	2	60
Cows on dry feed	80	20	1	1	30
Cows on pasture	250	20	3	4	90
Dried		150	0		500
Dried, cows on dry feed	650				
Dried, cows on pasture	2,000				
Milk, skim	2				
Dried	20	180			625
Molasses		0			
Oats	0	135	0		
Okra	600				

[7] Same as apples from which made.
[8] The values given on the container should be used.

TABLE 3.—*A digest of quantitative values for the vitamin A, B, C, D, and G content of foods*—Continued

Food	Units per 100 g of—				
	Vitamin A	Vitamin B	Vitamin C	Vitamin D	Vitamin G
Olive, canned:					
Green	280				
Ripe, Manzanillo	250	3	0	0	0
Ripe, Mission	100				
Olive oil, refined	0			0	
Onion	0	10	15		10
Orange juice	67	60	65		35
Oyster	200	150		5	
Parsley	75,000		150		
Parsnip		75			
Pea:					
Green	1,000	*50	40		*50
Dried	1,250	140	0		125
Peach:					
White	5		12		
Yellow	1,000				
Yellow, dried, not stored	4,500		50		
Peanut		650			200
Pear	12	*35	7		75
Pecan	200	*100			*100
Pepper:					
Green	950	*12	200		*12
Red	5,500		250		
Pigeonpea	250	*300			200
Pineapple	80	50			25
Pineapple juice			20		
Plum			10		
Pork, lean muscle	0	370			125
Potato	40	40	15		25
Prune	2,000		8		
Dried commercial	2,500		16		260
Pumpkin			10		
Quince			9		
Radish		*25	50		*25
Raisin	70	0	0		
Raspberry			35		
Rice:					
Brown		110			
Polished	0	0	0		
Polishings		600			75
Roe	3,000	140			
Rutabaga:					
White or yellow			40		
White	0				
Rutabaga juice			45		
Rye		110	0		
Soybean, dried, yellow		500			900
Spinach	25,000	60	80		125
Squash, Britton	2,000				
Strawberry			50		
Sweetpotato, yellow	5,000	70	15		35
Tangerine			50		
Tomato:					
Mature, green	800	33	25		
Ripe, red	1,500	35	30		12
Turnip:					
White or yellow		30	40		20
White	0				
Yellow	16				
Turnip greens	(9)	60	100		300
Veal					125
Watercress		60	100		100
Watermelon	90	17	14	0	14
Wheat	15	150	0		80
Bran		200			
Germ		1,200			300

[9] High.

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